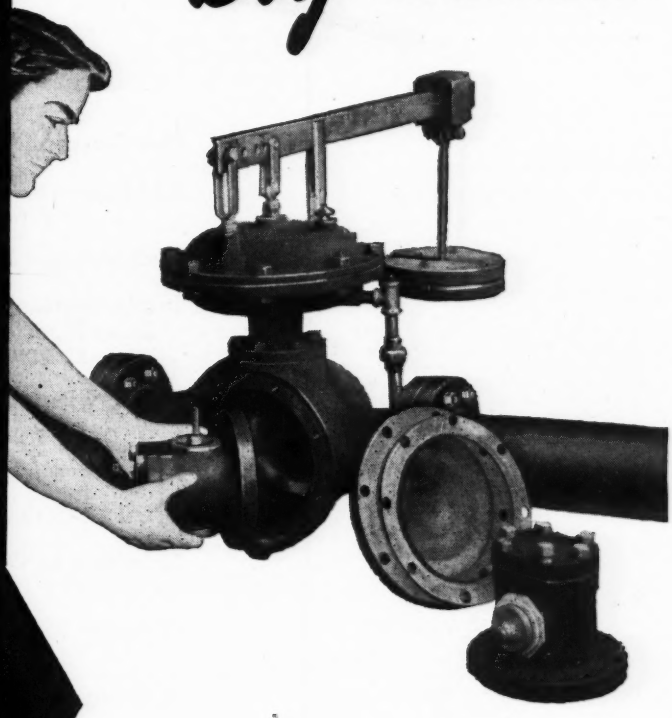
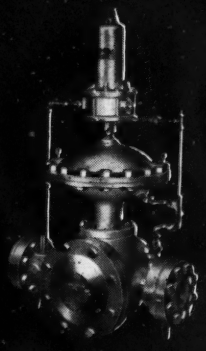
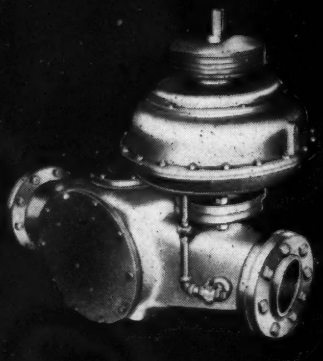
Can You Do This... WITH YOUR Big REGULATORS?



REPLACE VALVE CHAMBERS WITH THE REGULATOR THE LINE

Illustrating how the valve chamber may be removed as a unit and replaced through a hand hole area in the body without disconnecting regulator from the line. Replacement chambers may have either hard or soft seats and can be of smaller size for reduced capacity requirements.





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26th YEAR OF PUBLICATION

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In This Issue

Ten thousand eyes will be on the GAMA show in Atlantic City this month. For a preview of this outstanding event, see p. 43.

EDWARD TITUS

THERMALLY THINKING

New Horizons

THE GAS INDUSTRY, and its allies, the manufacturers of gas appliances, are arriving at the 32nd Annual AGA Convention in a frame of mind to keep pushing on to greater and greater achievements. The decade ahead is still a decade of immense opportunity.

There are plenty of disgraceful old ranges to be replaced. And there will be appliances of all sorts to sell. Better not let up, because the electric fellows are right there to make the most of any slow-down and gain an advantage, as some felt they did during the recent war. When and if things tighten more, then will be the time to adapt to the new situation.

Suppose manufacturers were cut back an average of one-fifth, so they could devote four-fifths to civilian production. Four-fifths is a pretty healthy proportion, considering the expansion of industry capacity in recent years. And some think the cutback through 1951 will be much less than one-fifth.

This contrasts with the early 1940's when production was stopped on automobiles and many other durables.

One factor at present is the lag between the appropriations by Congress for defense purposes and actual expenditures. It takes time to get government military expenditure programs advanced to the point where labor is at work in factories actually creating the products.

GAMA says there are 1200 new and improved products in the exhibit this year. These products represent plenty of opportunity for selling, for building the gas load. The current issue of *GAS* is devoted partly to the subject of research and new developments, which are a tribute to the progress the industry has made during the years since the end of the last war, and a forecast of progress in the decade ahead.

Today vs. Ten Years Ago

SOME RATHER EFFECTIVE ARGUMENTS against the too hasty imposing of too stringent controls have been circulated by the Chamber of Commerce of the United States, whose president, Otto A. Seyferth, is a speaker at the session Oct. 3. Oct. 3.

It would seem to be common sense of practical politics that not many controls will be imposed until some time after election anyway, because of adverse effect on votes.

Despite our unpreparedness at the present time, it is nothing to the unpreparedness of 1939, industrial and otherwise. In other words, industry is in a position to take the current emergency much more in its stride than it was to cope with defense preparations 10 years ago.

In 1939 there were only 370,000 men in the armed forces. In June of this year there were 1,500,000. A decade ago most heavy industries had to be retooled, and entire new industries created, like synthetic rubber. Essential raw materials were cut off in the early '40's, but in recent years the nation has been stockpiling raw materials.

The chamber says inventories of materials and goods are nearly 300% of the 1939 figure. This represents a cushion against over-stringency of supply.

Of course the government could take a step toward reducing supply stringency and curbing inflations by sharp cutting of non-essential expenditures. But this is a boring, even nauseous thought to many in the District of Columbia.

Excess Profits Tax

THE HIGH PRESSURE put on Congress during the last half of September for immediate enactment of a *retroactive* excess profits tax was perhaps due to some selfish groups who thought they would benefit if industry got scared and started handing around money they thought the government was going to get anyway.

While everyone concedes the need for higher taxes in a period of emergency, the excess profits is a fluky sort of tax. It often fails to hit those whom it is intended to hit. But it can work hardships on those who really have not had excess profits in any common sense interpretation of the phase. A large manufacturer or commercial company which had substantial profits during a base period would not suffer at all. Meanwhile a small company, just getting started during this base period, might be assessed a tax which would drive it to the wall.

In the utility field, an excess profits tax, particularly a badly drawn measure, could have effects that would be evil from the point of view of the general public. Too heavy a tax squeeze, resulting in lower profit, could add to the difficulty of raising capital by sale of securities for needed expansion.

If this in turn led to public ownership of given utilities, they would thus go off the tax rolls—a perfect example of killing the goose that laid the golden egg.

The utility industry can make out a very good case for being exempted altogether from operation of the excess profits tax. The industry's rates and profits are held to non-excessive figures by state public service commissions.

From a public relations point of view, however, it will probably be unwise for the industry to seek complete exemption from excess profits taxes if they come along. Better to seek a fair break in the law and its interpretation.

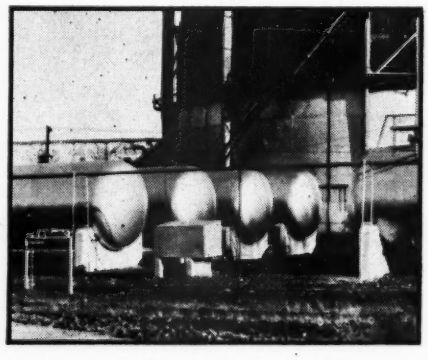
In view of the high proportion of debt to total investment, of most utilities, they should be allowed to count 100% of their debt structure in the invested capital on which the company would be allowed to earn a rate of return free of the excess profits tax. By this and other provisions, it should be possible to mitigate the effects of a bad tax.

YOUR GAS UTILITY CAN PROFITABLY EXPAND BY USING PHILLIPS *66* LP-GAS

Is your town growing? If it is, you are probably considering how you can profitably serve new customers in outlying districts.

By using some of your present facilities and by installing a Phillips *66* LP-Gas System, you can increase your present gas sendout—economically. Such an installation can be made in a few weeks.

For complete information write for Bulletins 174 and 175. Or ask to have a Phillips *66* field engineer call. He will help you decide which Phillips *66* LP-Gas System best fits your particular needs. No obligation, of course.



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GUY CORFIELD

TECHNICAL TRENDS

Plastic Pipe Again

THE CURRENT WAR DEVELOPMENTS, with the implications of material shortages, would seem to revive the interest in substitute or alternative materials, and one of the first which comes to mind is plastic pipe for underground service. During the last war a considerable quantity of small diameter plastic pipe was installed by gas utilities and, as far as this writer is aware, no undue failures or difficulties have resulted and the installations have been reasonably if not eminently successful. Presumably also, the facilities and techniques for production of plastic and fabrication of tubing have improved in the interim so that adequate and dependable supply may be assumed.

To review briefly the various kinds of plastic material—there are two general types, thermosetting and thermoplastic. The thermosetting type is produced by mixing the ingredients at a temperature at which they are fluid, introducing the mixture into a mold, and keeping it at the mixture or slightly higher temperature until it polymerizes or cures to its final solid state; subsequent heating will not soften it unless carried to the decomposition temperature of about 450° F. A modification of the thermosetting type are the polyesters, which are initially fluid at ordinary temperatures and can be polymerized to solid form by the addition of a catalyst with moderate heat; they are easier to mold because of their greater initial fluidity.

The thermoplastic type of plastics are, as their name implies, plastic or semi-fluid when heated and, while excessive heat will decompose them, the temperature at which they become plastic (about 350° F) does not affect or change their properties and they resume their normal hard state when cold. These materials are commonly available in granular form and can be fabricated into the desired shapes by melting and either forcing into a mold or extruding through an appropriately shaped orifice.

The former (thermosetting) type is the cheapest and, except for low impact strength, appears to have the best inherent properties for underground gas piping. If methods can be developed for cheap molding or other fabrication into pipe form, with an incorporated fabric lamination to give impact strength, these materials should be important to our industry.

The thermoplastic materials, because of ease of fabrication into tubing by simple extrusion methods, are the most economical as regards price of finished product and, where physical properties are appropriate, appear to warrant further consideration by the gas industry. Typical among them are Ethocel (ethyl cellulose), Saran (vinylidene chloride polymer) and Tenite II (cellulose acetate-butyrate). The latter has been the one principally used for existing gas piping installations and is also being employed for water distribution, lawn sprinkling systems, etc.

VIC—Offspring of PAR

EVERYONE IMMEDIATELY RECOGNIZES PAR as standing for Promotion, Advertising and Research and being the symbol of advancement in the gas industry. More recently, within the research side of the PAR triangle, there has been created, by E. D. (Gene) Milener, AGA coordinator of utilization research, the symbol VIC, standing for venting, ignition and combustion, and expressing the three elements necessary for the successful utilization of gas through appliance design, installation and operation. It will be immediately evident that VIC is another triangle with the basic characteristic of inherent stability if all sides are strong.

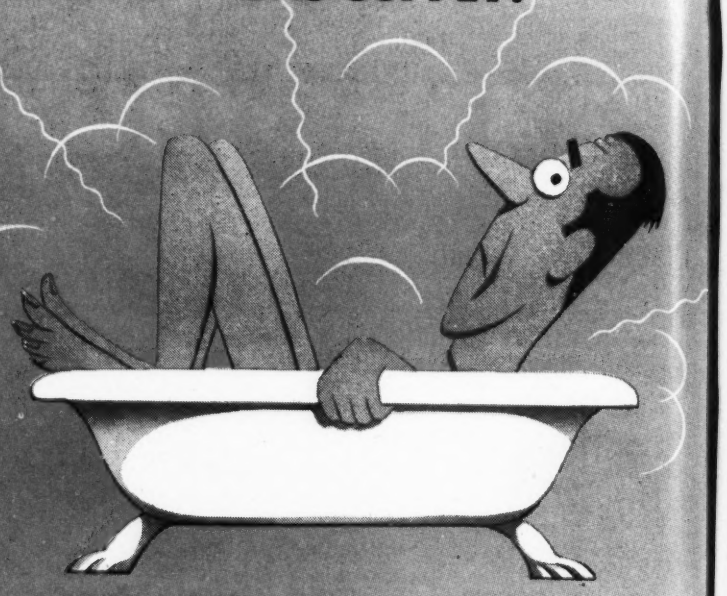
Those who have to do with research, development, installation, operation or servicing of gas appliances—or, for that matter, any installations involving gas combustion—could well use VIC as a watchword to be kept constantly in mind, because the elements or requirements it symbolizes must be met successfully if the installation is to be satisfactory. Furthermore, as Mr. Milener stated when he introduced this symbol to the AGA Domestic Gas Research and Utilization Conference in Cleveland last April, "The basic technical improvements in gas appliances, as distinguished from other appliances, are measured in terms of improvements in VIC. Future improvements in gas appliances, and I daresay their very survival, will depend chiefly upon our success in improving VIC."

Testing for Atmospheric Pollution

AS AN INDICATION OF THE IMPORTANCE which contamination of the atmosphere is assuming in our industrial and social life, the American Society for Testing Materials has formed a new technical committee on sampling and analysis of atmospheric pollution. This committee, as is proper and consistent with ASTM activities, will confine its efforts to the instrumentation and techniques of sampling and analyzing atmospheric constituents, and will not attempt to explore biological or health aspects or set up tolerance limits. The difficulties of collecting and analyzing the minute and dilute substances—solid, liquid and gaseous— which may contaminate air can be readily visualized, and it is to be hoped that ASTM, with its representative and impartial approach, will be able to bring order to what is now a highly involved, argumentative, and almost chaotic situation.

The gas industry should keep a complacent but also watchful eye on all developments in connection with atmospheric pollution—complacent because the purity of fuel gas and the ease of obtaining perfect combustion preclude the possibility of combustion products, as such, significantly contributing to the problem; but watchful because the large quantities of gas burned every day, and the wide variety of commercial and industrial applications which may produce atmospheric contaminants for reasons other than the combustion of the fuel, give the industry a wide "front" or exposure to unjustified accusations both unknowing and deliberate.

IN HOT WATER ABOUT YOUR LP-GAS SUPPLY?



Then it's time to switch to Warren! You can order from Warren with confidence, knowing we have all three of the essentials for adequate supply . . . the plants to PRODUCE large supplies of Butane and Propane . . . the terminals to STORE them to meet peak demands . . . the facilities to TRANSPORT them when and where needed. "Take the heat off" . . . with Warren!

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MEMBER

STANLEY JENKS

PROMOTIONAL NOTES AND NOTIONS

Boardwalk's Best

WELL! Here we are again at Atlantic City, meeting old friends, making new ones, enjoying an excellent AGA program—evidently, the program and entertainment committees consider sleeping anti-social — and feeling very pleased about the quality and variety of the GAMA Exposition.

Of course, the old tag about not getting any more out of a convention than you put into it still remains fundamentally correct. But a national convention like ours has something added that makes it well worth the effort. Call it morale, call it whatever you please, but recognize that here you have *the* gas industry, human beings like yourself, not an inanimate hookup of pipelines, distribution systems, compressors, appliances and equipment. These men and women, each in his own capacity and sphere, have something very much in common with you: the continued successful growth of an industry which started around 150 years ago as a substitute for a candle, to become today a great and essential social welfare service in the American industrial and domestic picture.

Cake Baking

'STRUTH!

I actually heard it at one of those outdoor daytime shindigs, where the dear girls pack the food, prepared with their own dear little hands, and the men play softball, horseshoes, or watch the proceedings with their eyes closed. I overheard what follows.

Two of the dear gals were discussing cake baking. One of them apparently had quite a reputation for a certain kind of cake— only two eggs, darling.

The cake baker, with true matronly modesty, was giving all the credit to (1) the recipe, (2) her electric mixer, (3) the thermostat on her gas oven, and (4) the time clock on the gas range.

The other gal was nodding understandingly and taking everything in stride until the oven timer was mentioned. Then she really sat up and took notice.

"Time clock on a gas range, darling?" she asked.

"Of course, darling."

"My lands! I never heard of such a thing, darling. *I thought only electric ranges had time clocks,*" she said.

Believe it or not, she had all the appearance of being an average, intelligent woman. Maybe, at that, she's a television addict. The TV electric appliances pressure gets greater every week, it would seem.

Pepping It Up

PRACTICALLY EVERYTHING HAS ALREADY BEEN SAID about the Old Stove Roundup, which should be in high gear now and remain so until December.

Perhaps, as success piles up, a timely word of caution might be in order. Today, with business as it is, first things naturally come first, and a sales manager's problem is not essentially what it should be.

Momentum, as everybody knows, will carry you just so far, and then, if you want to keep going, you have to turn on the power again. Today, the momentum of present conditions will keep things rolling for some time, its duration dependent mainly on the degree of inflation we experience.

But, so long as the gas industry has the facilities to serve its present and added customers more adequately, it looks to its sales executives to set things up to this end. A sales executive on the job thinks things out from all angles, formulates his plans accordingly, and then assumes the direct responsibility for first putting them in workable shape and then putting them over. It takes alert thinking to do this. When sales are whooping it up, you maybe can't hear the competitive wolves baying at your door; but they are there all the same. The greater your current success, the greater the pack it attracts.

Therefore, as this paragraph started out on a cautionary note, it can very fittingly conclude with the suggestion of not letting present activities lull us into a false sense of future security.

The power for next year's successful sales campaigns is being generated in alert brains right now.

Publicity

HAVE YOU NOTICED the better "press" the gas industry is getting these days? Somebody in headquarters deserves a lot of credit for getting the activities of our industry favorably presented in the news.

There was a time—and not too long ago at that—when a press clipping bureau would have starved to death feeding solely on gas industry clippings. Not so today.

Reading newspapers has more of a wallop when you see your own industry headlined and you realize that the public at last is being let in on activities and results of which we as insiders are justly proud, but which editors felt had no public interest.

It's all part of the well-deserved build-up our old, but still on-its-toes, industry is earning by the sweat of its brow in the public service.

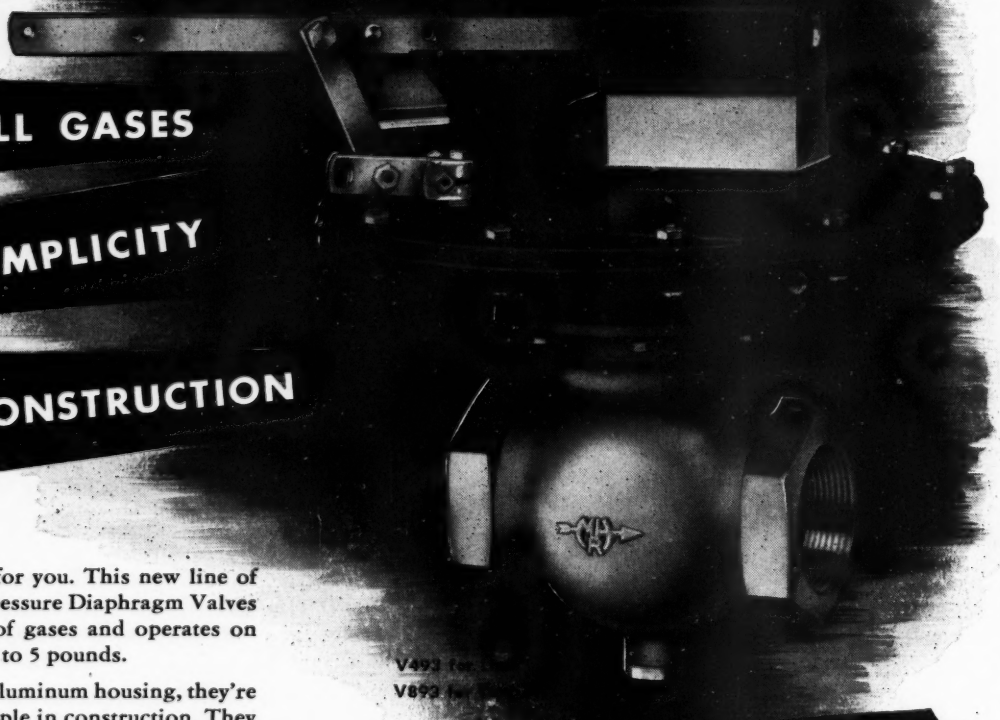
Now – HONEYWELL DIAPHRAGM VALVES for PRESSURES UP TO 5 LBS.

CAST ALUMINUM HOUSING

HANDLES ALL GASES

EXTREME SIMPLICITY

RUGGED CONSTRUCTION



GREATER POWER

HERE'S a real work horse for you. This new line of Honeywell High Pressure Diaphragm Valves will handle all types of gases and operates on pressures from 3" W. C. to 5 pounds.

Built with a cast aluminum housing, they're extremely rugged and simple in construction. They give you better all around performance and far more power for dampers.

These new valves are available in either low or line voltage; 9, 13, or 16 inch diaphragm sizes and 1 to 6 inch body sizes. The opening timing is adjustable and the valves themselves are extremely fast closing and have the fail safe features. Valves close in event of binding air doors or diaphragm rupture. The controller is the same on all sizes which simplifies your stocking and servicing.

If you want the finest in high pressure diaphragm valves, you'll want this new Honeywell V493 or V893. Let our representative show you its many advantages. Minneapolis-Honeywell Regulator Company, Minneapolis 8, Minnesota. In Canada: Leaside, Toronto 17, Ontario.

MINNEAPOLIS **Honeywell**

FIRST IN CONTROLS

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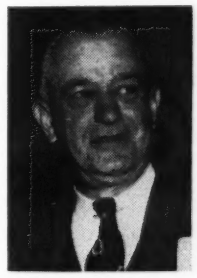
GAS CONVENTIONEERS CHART BIGGEST YEAR IN FACE OF INTERNATIONAL JITTERS

The world is in a crisis situation this month, as AGA convention delegates meet in Atlantic City, but the industry will continue its program of sound expansion so long as it is in the public interest.

UNDETERRED by war and threat of war, and determined to push ahead a program of sound expansion in the face of official confusion and vacillation so long as such a program remains in the public interest, the gas industry in record numbers is in Atlantic City, N J., this month for its annual nationwide caucus—the 32nd annual AGA convention.

Indicative of the industry's spirit is the attention that is being given at the convention to the subject of natural gas conversion, the "open Sesame" to almost limitless expansion of gas service. Hardly will delegates have had time to settle themselves and unpack their bags before they will be gathering in the auditorium ballroom (at 10 a.m. Monday, Oct. 2) for a shirtsleeve give-and-take panel on problems of introducing natural gas into manufactured gas systems. A joint meeting of the Natural and Manufactured Gas Departments, this session will be chairmanned by Presidential Nominee D. A. Hulcy, Lone Star Gas Co., Dallas, and will present as experts executives of companies which have recently converted.

A talk on "Fuel Resources of the Nation," election of officers of both departments (Manufactured Gas Department Chairman George F. Mitchell of Peoples Gas, Chicago, will direct the business of his department at this time), and a report of the time and place committee for the Natural Gas Department spring meeting will wind up the meeting and clear the decks for the first general session starting at 2 p.m.



Hugh H. Cuthrell

. . . enlightened

Retiring President Hugh H. Cuthrell of Brooklyn Union, who has distinguished himself with one of the most enlightened administrations in association history, will head a brilliant corps of three speakers on the opening general session. His talk, "Gas —The Flame of Progress," will review the record-breaking achievements of the past year.

Following him will be University of Pennsylvania President Harold E. Stassen, whose theme "Utilities and Freedom" will point up the necessity for selling the free enterprise system as our best safeguard against chaos.

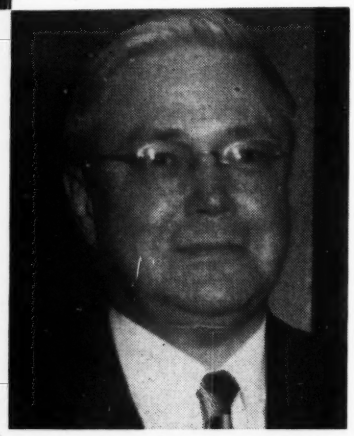
Attorney James K. Polk will close the session with an expert's views on "Social Security Unlimited."

Other general sessions, on Tuesday, Oct. 3 and Thursday, will feature Wallace G. Strathern of Eastern Gas & Fuel Associates, Boston, speaking on "How to Be Human on the Job"; U. S. Chamber of Commerce President Otto A. Seyfurth on "The Contribution

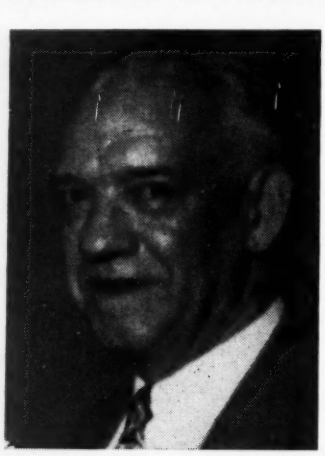
Election Ballot →

D. A. HULCY (left), president of Lone Star Gas Co., Dallas, takes over as AGA president for the next year.

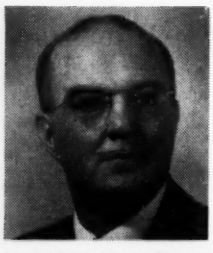
GEORGE F. MITCHELL (below), will become first vice president when the association elects officers. He is president of Peoples Gas Light & Coke Co., Chicago.



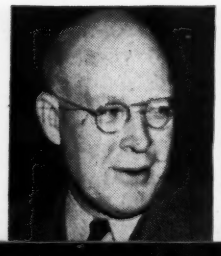
C. E. BENNETT (below), president, Manufacturers Light & Heat Co., Pittsburgh, was nominated for second vice president.

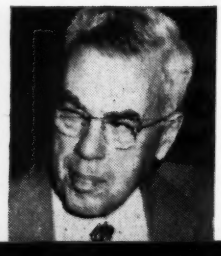


E. F. BARRETT (right), president of Long Island Lighting Co., Mineola, N. Y., will serve as AGA treasurer.



R. A. Hornby, Pacific Lighting Corp., and A. W. Conover, Equitable Gas Co. (top), will be AGA directors, as will F. C. Smith, Houston Natural Gas Corp., and C. G. Young, Springfield Gas Light Co. (bottom).





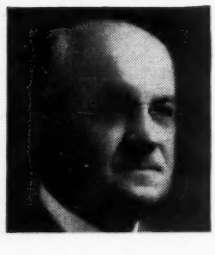
of Business Management to the National Welfare"; two top gas appliance salesmen and apostles of aggressive selling, W. Paul Jones of Servel and Stanley H. Hobson of Roper, beating the drums on their favorite theme; James F. Oates of Peoples Gas, Chicago, stressing the need for superlative service as a means of retaining public favor in a talk titled "Leveling Hills and Valleys Is in the Public Interest"; and W. L. Hayes, Montana-Dakota Utilities Co., who will tell why "Keeping the Public Sold on Gas Is an Industry Responsibility."

Thus, the accent is still on sales and expansion — despite thickening war clouds.

A similar tone pervades the agenda for industrial and commercial and domestic gas sessions. In a session of the industrial-commercial session, John J. Bourke of AGA will tell "Who is Winning the Commercial Fight." Two panels of three experts each will discuss "Formula for Sale" and "Opportunity Unlimited" before residential section delegates.

Other sections have lined up solid programs built on timely topics. Gas production, corrosion, measurement and metering, and conversion are accented in the operating section's lineup of events. Importance of television in advertising activities will be underscored in the home service round table when Louise Winslow, "television home economist" for TV-conscious East Ohio Gas Co., Cleveland, tells about "Tele-

N. B. Bertolette, Hartford Gas Co., and R. G. Taber, Atlanta Gas Light Co., top, will serve as directors; so will Henry Fink, Michigan Consolidated Gas Co., R. W. Otto, Laclede Gas Co., bottom.



F. O. Hess, Selas Corp. of America, and L. C. Harvey, Affiliated Gas Equipment Inc., top, are on the ballot for directors as are E. J. Boothby, Washington Gas Light Co., and L. B. Bonnett, Consolidated Edison Co. of New York Inc., bottom.

vision Techniques." Accountants are looking forward to hearing H. Frank Carey of Long Island Lighting describe "Advanced Thinking in Plant Accounting" at a luncheon meeting on Tuesday. Two group meetings are on deck for the following morning.

A special feature will be the Wednesday morning personnel relations session, when two promising subjects will be discussed: "Employee Relations and Management in a War Economy" and "Are 'Graybeards' White Elephants?"

Thursday is "Dealer Day," and a special session has been planned with Herb Names of Denver as chairman.

Awards and special presentations will include the AGA-Servel-sponsored "Big Six" gas refrigeration contest, crowning of the "King of the Court of Flame," plus the regular annual awards.

George E. Whitwell, vice president of Philadelphia Electric Co., chairmanned the general convention committee.

AGA nominees expected to be unanimously elected at the convention are shown on these pages. GAMA, which elected a slate headed by Frederic O. Hess, president of Selas Corp., Philadelphia, at its annual meeting at White Sulphur Springs, Va., last May, will induct the new men at a board meeting to be held concurrently with the convention Oct. 2.

Serving with Mr. Hess will be Louis Ruthenburg, Servel, and A. B. Ritzenthaler, Tappan Stove, vice presidents; Lyle C. Harvey, Bryant Heater, treasurer; and Managing Director H. Leigh Whitelaw, secretary.

CONVENTION GUIDE

SUNDAY, OCTOBER 1

1 P.M. to 5 P.M. Registration begins, in lobby, auditorium. Booth open every day.

MONDAY, OCTOBER 2

9 A.M. to 6 P.M. GAMA Exhibition of Gas Appliances and Equipment, arena, auditorium (every day)
10 A.M. Natural and Manufactured Gas Departments, joint meeting, ballroom, auditorium
2 P.M. General session, ballroom, auditorium
9 P.M. Reception by president, recreation, dancing, ballroom, auditorium

TUESDAY, OCTOBER 3

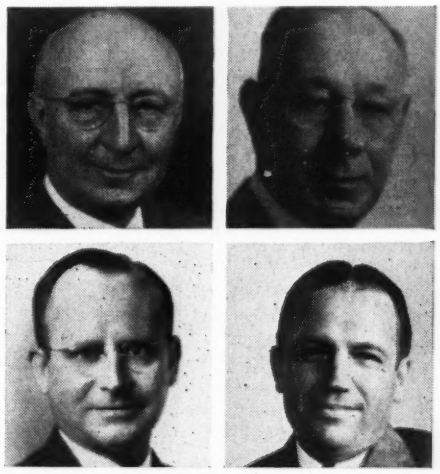
10 A.M. General session, ballroom, auditorium
12:30 P.M. Industrial and commercial gas section, luncheon meeting, Rose room, Hotel Traymore
Accounting section, luncheon meeting, Rutland room, Haddon Hall
2 P.M. Ladies party, Trimble room, Hotel Claridge
Operating section, room B, auditorium
Residential gas section, ballroom, auditorium

WEDNESDAY, OCTOBER 4

8 A.M. Home service breakfast, American dining room, Hotel Traymore
10 A.M. Industrial and commercial gas section and residential gas section, joint meeting, ballroom, auditorium
Operating section, room B, auditorium
Home service round table, Rose room, Hotel Traymore
Employee relations session, room A, auditorium
Accounting section, customer activities group, room 20, auditorium
Accounting section, general activities group, room 21, auditorium
9 P.M. Dancing, ballroom, auditorium

THURSDAY, OCTOBER 5

10 A.M. General session, ballroom, auditorium
2 P.M. Operating section, room B, auditorium
Dealers meeting, ballroom, auditorium
Insurance discussion meeting, Belvedere room, Hotel Traymore
9 P.M. Dealer - manufacturers - utility night, ballroom, auditorium

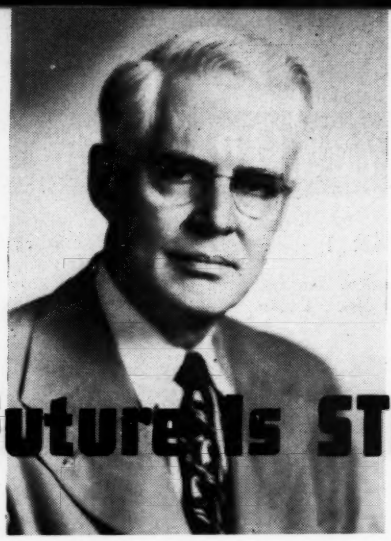


W. Reed Morris, Koppers Co. Inc., will chairman the manufacturers section; H. B. Andersen, Philadelphia Gas Works Co., is vice chairman of operating section; bottom: C. H. Horne, Alabama Gas Corp., is to be chairman of the residential gas section, and W. J. Schmidt, Long Island Lighting Co., will be his vice chairman.

A. C. Taylor, Consumers Gas Co., is to be a director; C. J. Allen, Connecticut Light & Power Co., top right, is to be chairman of the publicity and advertising committee. J. L. Haley, Niagara Mohawk Power Corp., and A. M. Beebee, Rochester Gas & Electric Corp., bottom, will serve as directors.

A. F. Bridge, Southern Counties Gas Co., is chairman of laboratories managing committee; A. A. Cullman, Columbia Engineering Corp., will chairman the accounting section. Bottom: R. Van Vliet, New York & Richmond Gas Co., will head the operating section; C. H. Lekberg, Northern Indiana Public Service Co., is chairman of industrial and commercial gas section.

H. A. Praeger, Brooklyn Union Gas Co., will be vice chairman of the publicity and advertising committee; R. F. McGlone, East Ohio Gas Co., is to be vice chairman of the accounting section. Bottom: R. A. Maloney, Bridgeport Gas Light Co., is nominated for vice chairman of industrial and commercial gas section; C. E. Bennett, Manufacturers Light & Heat Co., is to serve as vice chairman of the laboratories managing committee.



The Future Is STILL Bright!

By STANLEY HOBSON, President, GAMA

THE most encouraging indications of an optimistic future for gas appliance and equipment manufacturers have been evident in my many personal contacts with industry leaders throughout the country. This confidence was further confirmed at a conference of chief executives of both utilities and gas appliance manufacturers held the week of Sept. 3 in Chicago. It was evident that utility executives are concerning themselves about the type, kind, and quality of appliances and equipment that they wish to go on their lines to capitalize on the increasing availability of all gases.

As I compose this article, I am reminded of the unanimity of all manufacturer executives as they set forth their strong feelings about the necessity for improved and higher grade appliances for the various uses involved. Further, I was impressed with the unanimity of opinion about the importance of sales manpower, the selection and training of more salesmen, the improvement of dealer outlets, as emphasis was put upon the necessity of utility executives' taking the lead in such vital matters.

Unusual Changes

The gas range, for example, has been undergoing some unusual changes during the past two years, and has shown more improvement as to quality and features than has occurred in any period since the early days when the Blue Star seal of approval was made mandatory. Field testing of the automatic gas range is presently going on and GAMA members are cooperating in these tests. As a result, a very optimistic view prevails among both utilities and manufacturers as to what the future holds for the cooking load with some of these newer appliances soon to become more and more generally sold.

The gas refrigerator, and its companion the gas range, along with the "New Freedom Gas Kitchen," has taken its place and is being strongly promoted as the acme of modernity in full kitchen equipment. No longer does the competitive fuel—electricity—claim this field alone.

In support of the kitchen program, with all of its improvements, is the addition to gas appliances of such items as the automatic gas-fired clothes dryer, and the automatic incinerator—all of which makes available to the buying public a full complement of appliances to serve the utility rooms which are usually adjacent to present-day kitchens.

A review of water heater appliances indicates that while there exists electric competition in that field, manufacturers are ready and are urging the sale of adequate capacity, higher quality gas water heaters, and the elimination of too small and low priced units, to combat such competition. With the recognition of the new home market as well as the vast replacement market, present day advertising, publicity, and proper sales training, and dealer outlet improvement, there is every reason to believe and expect that inroads into the natural right of gas to the water heating load will be more than overcome.

Househeating and air conditioning comprise one of the most natural uses of the present and increasing supply of gas throughout the nation, and manufacturers have available all types and cacpacities of units for new and replacement installations. The task of supplying the vast market naturally has to be kept in step with the increased supply of natural gas now coming into almost every territory in the United States. While it appears that the demand far exceeds the ability of manufacturers to supply at the present time, all manufacturers who belong to GAMA have geared themselves to take care of those demands.

Uniform Policies?

Again referring to the recent executive sales conference, I believe it would be premature for anyone commenting on that meeting to indicate whether or not uniform policies are possible as a result of the high level deliberations which took place. I do repeat, however, and I am sure I voice the opinion of a strong majority, that such a meeting is indicative of the intense interest of both utility and manufacturer working together in their distribution and product improvement problems. Speaking for the manufacturers, I am sure that they were more than pleased with the evident interest on the part of utility executives in the work appliance and equipment manufacturers are doing in their research laboratories as they busy themselves upon improvement of appliances. There is further tangible evidence of that interest as we review the research work now being sponsored and financed by PAR funds, collected by the utility people and expended for promotional, advertising, and research effort.

Almost every modern gas appliance and piece of equipment used in domestic, commercial, and industrial fields will be displayed to utility people at the GAMA exhibit in Atlantic City. The manufacturers who are putting on this exhibit expect the biggest attendance of utility people and dealers that has ever been recorded.

Everybody recognizes that all of this work is being carried on under conditions of uncertainty, brought about by the Korean situation and by orders for mobilization of manpower and industry to support a preparedness program of proportions akin to that of an all-out emergency. But the thinking of utility executives and manufacturers, as indicated by the actions of AGA officers and its board, reflects the ability of such people to think broadly about two situations: *The emergency and the necessity for support of an economy in a country where great progress is being made.*

I am confident those attending the AGA convention will indeed find a great stimulus in that which is on the program, as well as in that which will be displayed at the biggest exhibit of gas appliances and equipment ever held.

RESEARCH AND PRODUCT DEVELOPMENT IN 1950

1950

Twelve hundred new or improved types of gas appliances and equipment, displayed by 175 manufacturers, utilizing more than 75,000 square feet of space . . .

These record-breaking statistics concisely sum up the biennial exposition of the Gas Appliance Manufacturers Assn. opening Oct. 2 in Atlantic City for a week's run.

It will be the biggest gas equipment show in history, and 10,000 utility men and dealers are expected to view it.

Products of industry-wide research and development, the equipment on display at the mammoth show is symbolic of what can be accomplished when utilities and manufacturers work together for progress.

On these pages GAS explains how this outstanding coordination of research effort produces end products, describes the mechanism of one of the most vital research projects in industry history, and gives its readers hints on the treats in store for them at a few of the 175 booths.

IMPLEMENTATION Serves As Vital Link Between Laboratory and Sales Floor

By Edward Titus

THE exhibit of the Gas Appliance Manufacturers Assn, this month, the largest show ever, includes no less than 1200 new and improved products. They vary all the way from clothes dryers and ranges to huge gas-fired industrial boilers and single unit heating-cooling devices.

Exclusive

Each new or improved product is the fruit of research in one form or other, whether by individual manufacturers, or by the gas industry as a whole through the PAR program, or some other branch of industry research.

These product improvements rarely if ever jumped full-blown out of somebody's mind or machine shop. They involved study of existing products and of needs of the industry and the consumer, along with painstaking experimentation.

The most attention-getting of the gas industry's efforts to serve the consumer better through research is the PAR program. And the industry in recent years has made a practice of sitting down with the manufacturers in a Domestic Gas Research and Utilization conference, each spring.

The purpose of this conference is to implement research, to try and see that the millions being spent on research actually bear fruit in improved product design and improved service.

A suggestion for future improvement to make the most of research in utilization came from J. W. West Jr., secretary of the PAR committee.

"Perhaps in the future," said Mr. West, "when a project uncovers technical data that affords the possibility of a substantial improvement in appliance design or basic performance, we should not be content with presenting and discussing that data as in the past, but should appoint another committee to get that data into actual use. We might call that a Project Action committee, and place upon it the representatives of those gas companies which feel that the potential improvement is important enough for them to indicate the minimum number of appliances which they would dispose of directly and/or through their cooperating dealers. With that information, we might invite as members the manufacturers who feel that such a product improvement is promising and important enough to their future for them to agree to develop it and put it into production."

Mr. West said he realized that not all utilities would be willing to commit themselves to the purchase and sale of an improved appliance at the necessary higher initial cost, nor would all manufacturers be willing to produce it. But in most cases of important improvements a startling basis would be provided of mutual benefit to both participants. And once started the merits of the improvement would determine the scope of its acceptance and availability from that point on by the industry.

Mr. West cited the Automatic Range Ignition Development project, covered in more detail elsewhere in this issue, as an example of putting the results of research to work.

Previous to the adoption of this plan, he pointed out, the industry had attempted to shorten the interval between research and improved appliances by publishing and discussing the results and leaving the rest up to the industry.

Perhaps, Mr. West suggested, it would be well to adopt the policy of the Post War Planning committee which not only published its 31 post-war recommendations to the industry, but set up an action committee to put them into effect.

A recent advertisement of the Bell Telephone Co. summarized the cycle from fundamental research to a final improved products in four steps:

1. Fundamental research uncovers the new possibility and finds the new idea.
2. Applied research and development makes the new idea work.
3. Design gives it form.
4. Specifications and production produce the product.

In the gas field, research has elevated the position of the gas utility industry in public esteem and in the minds of the financial world leaders. The simple fact of the gas industry joining other great American industries by adopting organized research as a basic weapon for growth and public service has brought about this change in public attitude. And a banker recently told the American Bankers Assn. that "One of the best tests of management in industry is its attitude toward research."

To what extent has the gas industry succeeded in the major objective of utilization research, to elevate the performance levels of gas appliances?

As Mr. West pointed out, no manufacturer of ranges could have been expected to change his designs during the war when 145-lb gas ranges were the rule and all were making war products. And the seller's market following the war was not conducive to incorporation of research data in new product specifications at a time when any product was sold before it was made.

In the last couple of years, however, active and aggressive interest in product improvement has returned.

If there has now been a temporary return to something like a seller's market in a few fields, it is well to bear in mind that much of this has been caused by panic buying rather than by fundamental conditions. With something like 90% of the nation's production likely to be available for non-emergency production during the next 12 months, there should be plenty of incentive to improve consumer products. If deliveries of steel are delayed for a while, it is well to get product improvements in the works and be ready for the time when plenty of steel is available again, and competition for the consumer's dollar will stiffen.

It has been estimated that 10 or 15 years usually intervene between fundamental research on an entirely new product, and availability of that product, with a lesser period in the case of improvements in specific features of an established product.

Already there are some undeniable evidences of association research being reflected in today's appliance design and performance.

An important example, Mr. West

points out, is that as a result of research bulletin No. 10 on atmospheric burner design in 1940 and subsequent work, the burners on most gas appliances today "show that this phase of appliance design has become less of an art as of old, and has taken on more and more the aspects of a science."

"The burner design as a whole is better," he said, "and some detailed features have also been improved. For example, some individual manufacturers now use a simple and improved design for a lintless-pilot air shutter which resulted from a research project on that subject."

In today's gas ovens and broilers a wide use has been made of heat distribution data uncovered by research work during the past several years. The basic data developed on single-point flash-tube gas ignition have been carried further by some manufacturers and research work on electric ignition has served to stimulate developmental efforts.

Other research work is reflected in some appliances available, such as some lowering of range grates and improved re-ignition of burners when partially opened, and the performance of furnaces when operated at reduced inputs.

In the industrial field, research work on gas radiant tubes has stimulated manufacturers' development and application of this technique to enameling and heat treating furnaces available for a wide variety of purposes. Some deep fat friers have incorporated the data derived from commercial cooking research.

Those connected with the PAR committee are eager to foster greater use of the technical data uncovered by expenditure of $1 million in the design and performance of today's gas appliances. It is for this reason that the idea of a project-action committee has been put forward, to follow out to some extent the method used in the automatic ignition project.

The people who attended this year's Research and Utilization conference heard a graphic description of "What is Needed to Develop Successful Products for Tomorrow's Competitive Markets," from C. G. Frantz, president of Apex Electrical Manufacturing Co. in Cleveland. The setup starts with a director of engineering, under whom project engineers function, each of whom heads up some specific product development or subdivision thereof.

The project engineers need proper tools and equipment, as well as capable assistance in the way of draftsmen, shop mechanics, cost men, and testing facilities.

An error to be avoided is overloading a project man with a variety of tasks so that effective concentration is impossible, thereby retarding the work.

There is need for regularly timed consultation with supervising engineers, because the possibility of changes that will mean improvements turn up as a project proceeds. Then, too, it is desirable to avoid deviation from the planned direction of the program without approval from those setting the policy.

Mr. Frantz feels that in order to have an efficient product development engineering organization, it is necessary to have a physical setup that permits concentration on the projects undertaken. In the case of his company, they have a completely separate location, as they have found that otherwise it is often a matter of too many cooks. Or even more disturbing is the demand so often made by the production department on the engineering talent to help them out of some trouble. This is a production engineer's job, and not that of a project engineer.

When the project engineer's work begins to take definite form there is need for consultation with patent people who can guide the design clear of possible infringement, and provide proper patent protection. A plant, or as he is sometimes called, a house attorney can be helpful in this respect.

An industrial designer or product stylist also can be useful. While an artist's versions of a product may gloss over practical requirements, nevertheless they are helpful in directing engineering people towards a more pleasing, therefore more salable design and frequently reflect more accurately the buyer's viewpoint.

In Mr. Frantz's company the following priority for scheduling engineering work has been developed:

First comes anything in the nature of trouble, which takes precedence over all other work; second is redesign for simplification and reduction of costs; and last is design for function or improvement which includes new design.

And who determines what projects are to be worked on—whether cost reductions, improvements or new devices and of what type, appearance, price class, and such important matters?

This is a most difficult determination, and Mr. Frantz describes the procedure of Apex Electrical Manufacturing as follows:

They have created a position with the title of product sales engineer who is a technically trained man with ample practical experience in engineering and sales work, who acts as a liaison contact between management, sales, customers and the engineering department. It is his job is to be familiar with industry trends, in order to translate for the various departments the needs or possibilities, and thus direct all available information into policy decisions.

Weekly meetings are held of an executive officer, the vice president in charge of engineering, the product sales engineer, the director of engineering, occasionally the director of research, one or more of the project engineers, sometimes the patent attorney, and usually the product stylist, for the purpose of detailed analysis of projects. The physical work of completing a project is often relatively simple when exact specifications are made known, and it is for this purpose that these meetings are regularly held.

In dealing with problems of redesign to achieve product simplification and reduction of cost, Apex Electrical has an established formula. This is to the effect that a project will have almost certain approval if the cost of reworking and acquiring new tools, together with the cost of necessary machinery, equipment, etc., will be offset by the total saving in production cost within a period of a year, but after discounting the effect of federal taxes—38% at the time Mr. Frantz was considering. On Apex Electrical's quantity production basis, this situation is not at all uncommon.

Summarizing his thoughts on successful competitive product development, Mr. Frantz said:

"Given the germ of an idea, which is all important, a well organized operating unit in personnel and facilities, the process of accomplishing the end result is one of intensive study and simplification, work and rework, design and redesign, engineer and re-engineer, to the point of complete exhaustion of possibilities—if that Utopia can ever be reached, which I doubt. The so-called completed design stage is only the starting place because only then can there be full observation of all details of function which permits study of further possibilities."

Mr. Frantz hurled a challenge to his gas utility and manufacturer listeners. His company is vitally interested in several industries, including domestic laundry and dishwashing equipment, both of which utilize liberal quantities of hot water. Their laboratory studies show the curve of cleansing effectiveness rising rapidly in proportion to the increase in temperature of hot water used.

To be specific, he said, 140°F is no longer acceptable for really efficient cleansing.

"Water 160° for clothes washing seems satisfactory," he said, "but we need 180° for dishwashing even with the best modern detergents, for quick results and to hygienically cleanse dishes. Our present solution is to build into the dishwasher a booster tank that constantly maintains the proper water temperature.

"I know this presents problems for you and the plumbing people, but my child-like faith in your ingenuity and

resourcefulness tells me you will discover the answer with corresponding benefit to your and our industry."

Stanley H. Hobson, president of the George D. Roper Corp. and president of GAMA, has pointed out that the utilization research of the AGA, combined with that of the manufacturers, serves as "an insurance policy for the continued superiority of gas as a fuel."

Up to here we've been talking principally about how utilization research is and can be further implemented in development of new products and improvement of present ones.

However, this is only one part of the broad picture of the implementing of research.

The picture as a whole has been reviewed this year by R. J. Rutherford, chairman of the AGA committee on Domestic Gas Research and president of Worcester (Mass.) Gas Light Co. Mr. Rutherford points out that one of the basic reasons for the cooperative PAR plan is the contrast between the competing electrical industry, where two companies alone sold nearly $3 billion worth of products, and the largest gas appliance manufacturer who did about $75 million. Mr. Rutherford listed the following achievements of PAR:

1. Developed the Hall process for making high-Btu oil gas from cheaper heavier oils.
2. Learned how to reform hydrocarbons in various forms to the maximum degree, ranging from natural gas up to and including gasoline. These are two answers to the peak load problems of many companies.
3. Learned a quick and accurate method of evaluating oils for carburetion or for producing high-Btu oil gas.
4. Learned a great deal of how mixtures of gases burn in gas appliances—that is, about interchangeability—which governs the types of gas which can be used with safety to customers and property and those which cannot. Thus far, more than 200 combinations of gases have been tested and evaluated. The use of these data in the industry has been widespread. It has prevented and will continue to prevent many costly trial and error mixing experiments.
5. Learned how to improve appliances, give them better adaptability to modern kitchen requirements and greater dependability of operation. These data are already in use.
6. Learned how to make better broilers and ovens.
7. Learned how to reduce grate heights with safety.
8. Learned a great deal about house heating, venting, operation, ignition and heat transfer.
9. Learned how to improve coffee urns and steam tables.
10. Learned how to improve kitchen ventilation and much about humidity in the home, its causes and prevention.
11. Learned how industrial gas heating compares with induction heating and what we must do to improve our position.
12. Learned some of the factors involved in enormous heat releases through new types of gaseous combustion of a jet character.
13. Learned how to avoid hydrate stoppages in natural gas transmission lines.
14. Learned much about the removal of nitrogen from natural gas..
15. Increased the accuracy of gas measurement through our orifice research.

Industry Launches Automatic Range Ignition Development Field Test

By EDWARD TITUS

THE most extensive field study of gas appliances ever undertaken starts Oct. 1. This is the nationwide Automatic Range Ignition Development project.

Exclusive

The project provides an example of how diverse and competing elements of an American industry can work together on a far-flung project that concerns them all.

The purpose is to develop a cool automatic range which will consume little or no energy when not in use.

The project has been the principal plank in the platform of Hugh Cuthrell, vice president of Brooklyn Union, as president of the American Gas Assn. for the year now ending.

Appearing before a group of manufacturers of ignition devices many months ago, Mr. Cuthrell said that for the PAR committee he could promise a fund for automatic ignition development if it would accelerate availability of the desired product.

He said the fund could be available for research if that was needed, or for developmental work if that was the missing link—or that it might be spent in a research or development laboratory or in a manufacturer's plant, or in any way best calculated to achieve success.

The manufacturers explained they were spending substantial sums for research and development on ignition already.

The missing link to accelerate product availability, they explained, was comprehensive and simultaneous field testing in consumer homes under representative gas service conditions of the ignition devices now available in the experimental stage.

It was not easy to iron out all the details and get the project under way. A great many points had to be agreed upon by the large number of utilities and manufacturers participating, in a long series of meetings.

Early in the discussions a set of objectives was drawn up. The primary purpose, it was decided, is to capitalize fully on the basic superiority of gas for cooking. It was pointed out that a challenging affront to the gas industry is contained in electric propaganda like the booklet about the alleged "Passing of the Flame."

Immediate aim of the automatic ignition project is to speed efforts of range and equipment manufacturers to design an automatic ignition system or systems that will be:

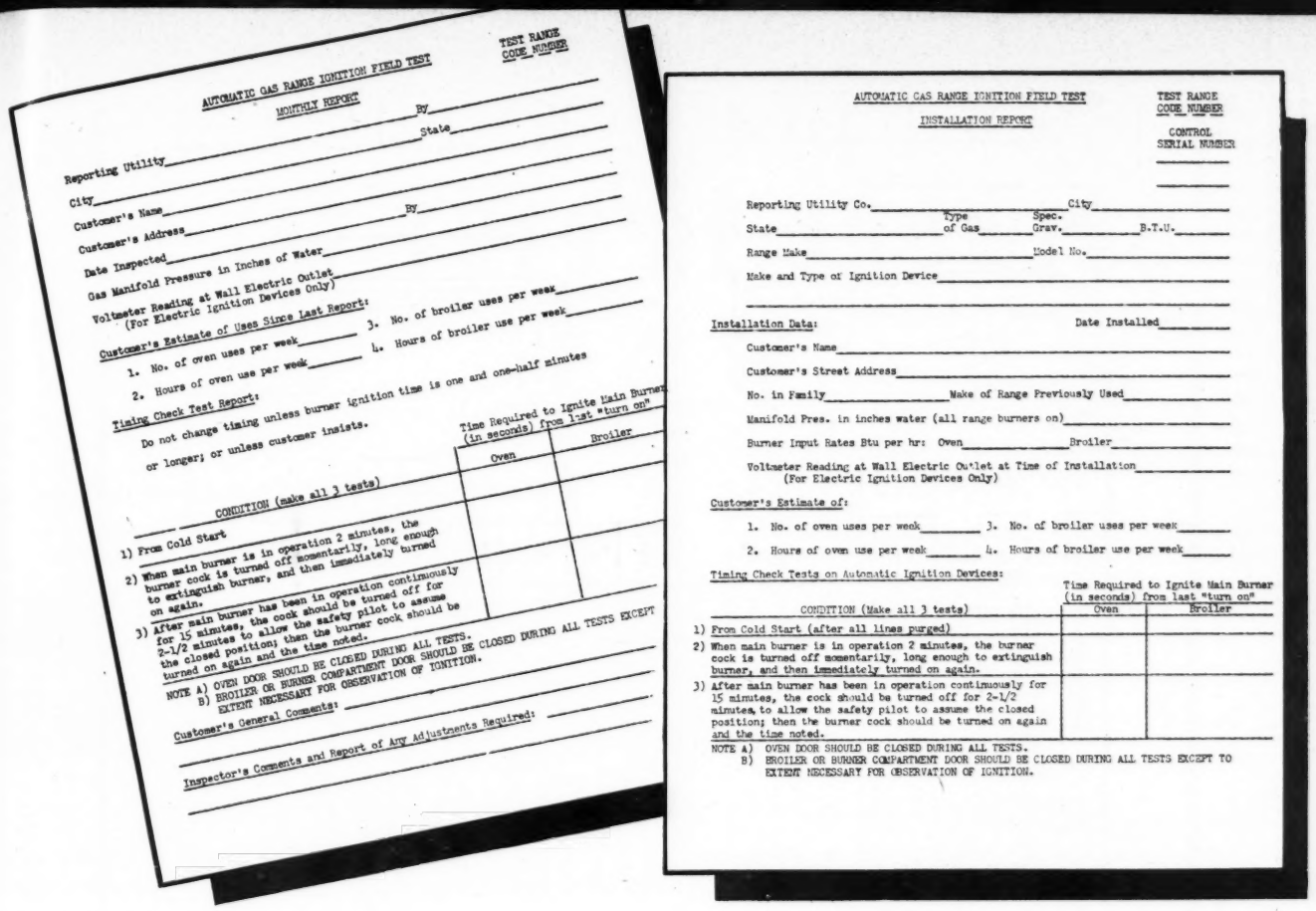
(a) reasonable in cost,

(b) easy and inexpensive to service,

(c) capable of manual operation, should power fail if electric energy is used,

(d) equally adaptable to manufactured, natural and mixed gases.

After the expected selection of the automatic ignition system or systems best adapted to service throughout the industry, it is proposed to follow through and stimulate use of such equipment by both utilities and manufacturers.



AUTOMATIC GAS RANGE IGNITION FIELD TEST

MONTHLY REPORT

TEST RANGE CODE NUMBER

Reporting Utility _____ By _____

City _____ State _____

Customer's Name _____

Customer's Address _____ By _____

Date Inspected _____

Gas Manifold Pressure in Inches of Water _____

Voltmeter Reading at Wall Electric Outlet _____
(For Electric Ignition Devices Only)

Customer's Estimate of Uses Since Last Report:

1. No. of oven uses per week _____ 3. No. of broiler uses per week _____

2. Hours of oven use per week _____ 4. Hours of broiler use per week _____

Timing Check Test Report:

Do not change timing unless burner ignition time is one and one-half minutes or longer; or unless customer insists.

CONDITION (make all 3 tests)	Time Required to Ignite Main Burner (in seconds) from 1-st "turn on" Oven	Broiler
1) From Cold Start		
2) When main burner is in operation 2 minutes, the burner cock is turned off momentarily, long enough to extinguish burner, and then immediately turned on again.		
3) After main burner has been in operation continuously for 15 minutes, the cock should be turned off for 2-1/2 minutes to allow the safety pilot to assume the closed position; then the burner cock should be turned on again and the time noted.		

NOTE A) OVEN DOOR SHOULD BE CLOSED DURING ALL TESTS.
B) BROILER OR BURNER COMPARTMENT DOOR SHOULD BE CLOSED DURING ALL TESTS EXCEPT TO EXTENT NECESSARY FOR OBSERVATION OF IGNITION.

Customer's General Comments: _____

Inspector's Comments and Report of Any Adjustments Required: _____

AUTOMATIC GAS RANGE IGNITION FIELD TEST

INSTALLATION REPORT

TEST RANGE CODE NUMBER

CONTROL SERIAL NUMBER

Reporting Utility Co. _____ City _____

State _____ Type of Gas _____ Spec. Grav. _____ B.T.U. _____

Range Make _____ Model No. _____

Make and Type of Ignition Device _____

Installation Data: Date Installed _____

Customer's Name _____

Customer's Street Address _____

No. in Family _____ Make of Range Previously Used _____

Manifold Pres. in inches water (all range burners on) _____

Burner Input Rates Btu per hr: Oven _____ Broiler _____

Voltmeter Reading at Wall Electric Outlet at Time of Installation _____
(For Electric Ignition Devices Only)

Customer's Estimate of:

1. No. of oven uses per week _____ 3. No. of broiler uses per week _____

2. Hours of oven use per week _____ 4. Hours of broiler use per week _____

Timing Check Tests on Automatic Ignition Devices:

CONDITION (Make all 3 tests)	Time Required to Ignite Main Burner (in seconds) from last "turn on" Oven	Broiler
1) From Cold Start (after all lines purged)		
2) When main burner is in operation 2 minutes, the burner cock is turned off momentarily, long enough to extinguish burner, and then immediately turned on again.		
3) After main burner has been in operation continuously for 15 minutes, the cock should be turned off for 2-1/2 minutes, to allow the safety pilot to assume the closed position; then the burner cock should be turned on again and the time noted.		

NOTE A) OVEN DOOR SHOULD BE CLOSED DURING ALL TESTS.
B) BROILER OR BURNER COMPARTMENT DOOR SHOULD BE CLOSED DURING ALL TESTS EXCEPT TO EXTENT NECESSARY FOR OBSERVATION OF IGNITION.

Installation report and monthly report on range ignition.

Meanwhile the project will aim to get utilities to promote automatic ranges increasingly, and adopt more uniform requirements for ranges.

The ultimate objective is to make available to the gas industry as a whole an automatically ignited gas range that will consume no energy when not in use.

It is also felt in some quarters that greater unification of the utility industry on the subject of automatic ranges will enable control manufacturers to arrive at greater standardization and greater volume, and enable them to spend more time on refining the system or systems adopted and less on fundamental research.

Some 49 utility companies, 16 gas range manufacturers, and six control manufacturers are participating in the project under the American Gas Assn's PAR program. The cooperation of the Gas Appliance Manufacturers Assn. also has been all-important in getting under way.

Eleven different types of automatic range ignition systems, seven electric and four single-point, will be thoroughly tested under actual operating conditions. A total of 200 automatic gas ranges will be equipped with each type of ignition, or a grand total of 2200 ranges.

According to Mr. Cuthrell, the tests will be conducted for a minimum period of six months. After that those in charge of the project will take stock and see if the test period needs to be extended.

The various range ignition systems will be operated under normal home conditions. Cooperating utilities will complete monthly and special report forms which will be forwarded to the AGA laboratories for processing and analysis. R. J. Rutherford, president, Worcester (Mass.) Gas Light Co., is chairman of the working committee which will supervise details of the field tests.

Gas ranges used in the study are being pruchased by the 49 participating utilities. Later they will be disposed of as these companies see fit.

Various methods are being used by the different companies in distributing the ranges. One company plans to distribute them chiefly among employees. Where the ranges are placed in customers' homes it is felt the customers should comprehend the purpose of the testing.

Another company has tried a plan of selling test ranges to a cross section of customers at prices equal to the prices without automatic devices. The company would convert the range to match ignition at no cost at any time the customer said she preferred that.

Not the least of the challenging features of the project is the difference in gases used and operating conditions among the utilities participating.

To meet this problem participating utilities were questioned in their registration information blank on type of gas supplied, Btu content, analysis, specific gravity, normal pressure, base load characteristics, per cent of peak teristics of supplementary gas, and supplementary gases to base gas, characcomments.

Electric information also was sought, including type of current, whether AC or DC, voltages, cycles, and voltage variations that may be encountered.

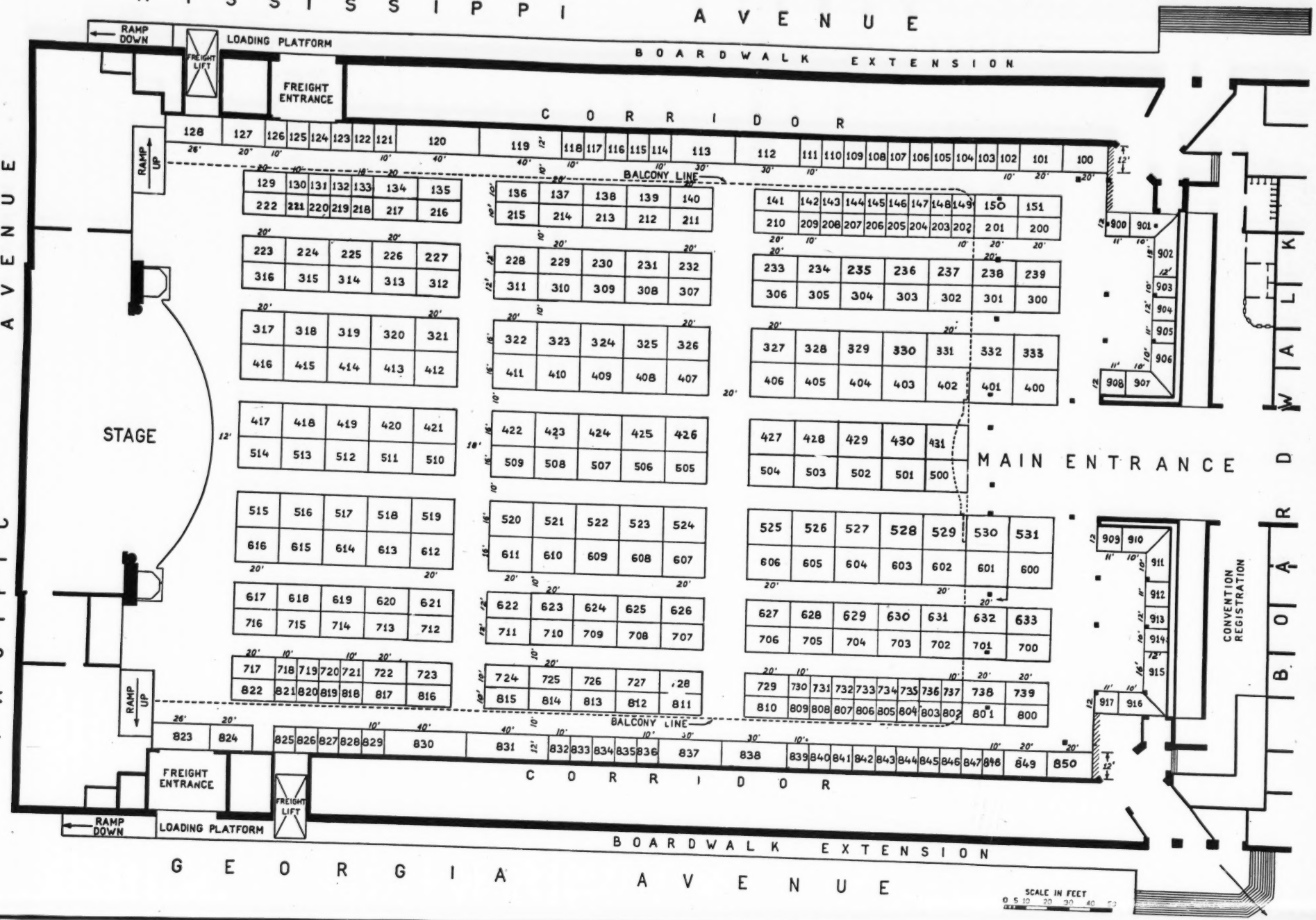
To facilitate the work of utilities, it has been suggested that a manual be compiled containing instruction forms and furnished to the utilities by all participating manufacturers.

Information utilities are asked to furnish in the installation report is shown in the illustration.

Similar information, brought up to date, will be collected on monthly reports, along with customer's general comments and inspector's comments and report of any adjustments required. Special reports are provided for details of any operating difficulties.

The AGA Laboratories are playing a large part in the project, approving the ranges and devices to be used, and receiving and analyzing the reports. The Laboratories are understood to be particularly interested in trying out automatic systems in locations where they face the most difficult conditions.

One description of the testing program is that it is an effort to crowd into one or two years what normally would take 15 years to accomplish.


MISSISSIPPI AVENUE
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FREIGHT LIFT
FREIGHT ENTRANCE
CORRIDOR
RAMP UP
BALCONY LINE
PACIFIC AVENUE
STAGE
MAIN ENTRANCE
BOARDWALK
CONVENTION REGISTRATION
GEORGIA AVENUE
SCALE IN FEET
0 5 10 20 30 40 50

WHAT THEY'RE SHOWING

A preview of some of the top-interest displays at GAMA's Atlantic City show and a guide to where they can be found

Hardwick Unveils New Single Point Ranges

POTENTIAL show stoppers at the GAMA Exhibition are the new Hardwick ranges equipped with single point ignition.

Keying their initial appearance to the start of the industry-wide automatic oven ignition testing program, Hardwick Stove Co. plans to display several models—including the unique high-oven Challenger—equipped with a new system which employs a single top burner pilot to ignite all burners.

A special feature is the standby pilot with safety valve, developed after years of laboratory research and testing.

Here is how it is constructed (see drawing):

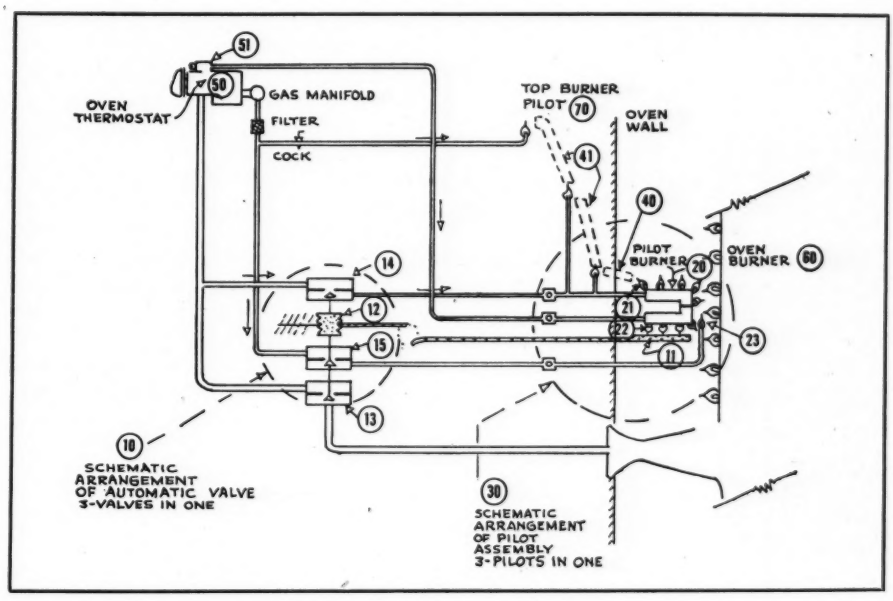
Main component parts (referred to by numbers) include the automatic valve (10), the pilot burner (20), the pilot assembly (30), the flash tubing (40), the oven thermostat (50), the oven burner (60), and the top burner or constant burning pilot (70).

The safety pilot valve (10) is of the mercury charged bulb (11) and bellows (12) type. Incorporated in this single unit is the main gas supply valve (13), the flash pilot valve (14), and the stand-by pilot valve (15). It is fixed in place by sheet metal screws and is removable from the front.

The pilot burner (20) consists of the flash pilot (21), the heating pilot (22), and the stand-by pilot (23), all incorporated in a single casting to insure permanent interrelationship of all parts. It is so arranged that a flame must be established at the oven burner (60) before the heating pilot is ignited.

The flash pilot has two sets of ports: One for charging the lower flash tube (40) with gas, which lights first, and the other which establishes a flame at the main burner and then ignites the gas at the heating ports.

The pilot assembly (30) is attached to the inside of the oven and is removable from the front. The mercury bulb (11) is held in alignment over the heating ports (22) by a clip held in place by a sheet metal screw. The primary air inspirators (39) are outside of the oven but removable with this assembly.



Schematic diagram of single point ignition system.

The lower section of the flash tube (40) is fixed to the pilot assembly and is removable with it. The upper section or sections (41) extend up to the top burner pilot (70).

The oven thermostat (50) with its connection (51) for the heating pilot gas supply is standard as to design and location.

The oven burner (60) is standard in all respects.

The top burner pilot (70) is standard. The top of the flash tube (41) is fixed to its frame but is readily removable.

Operation

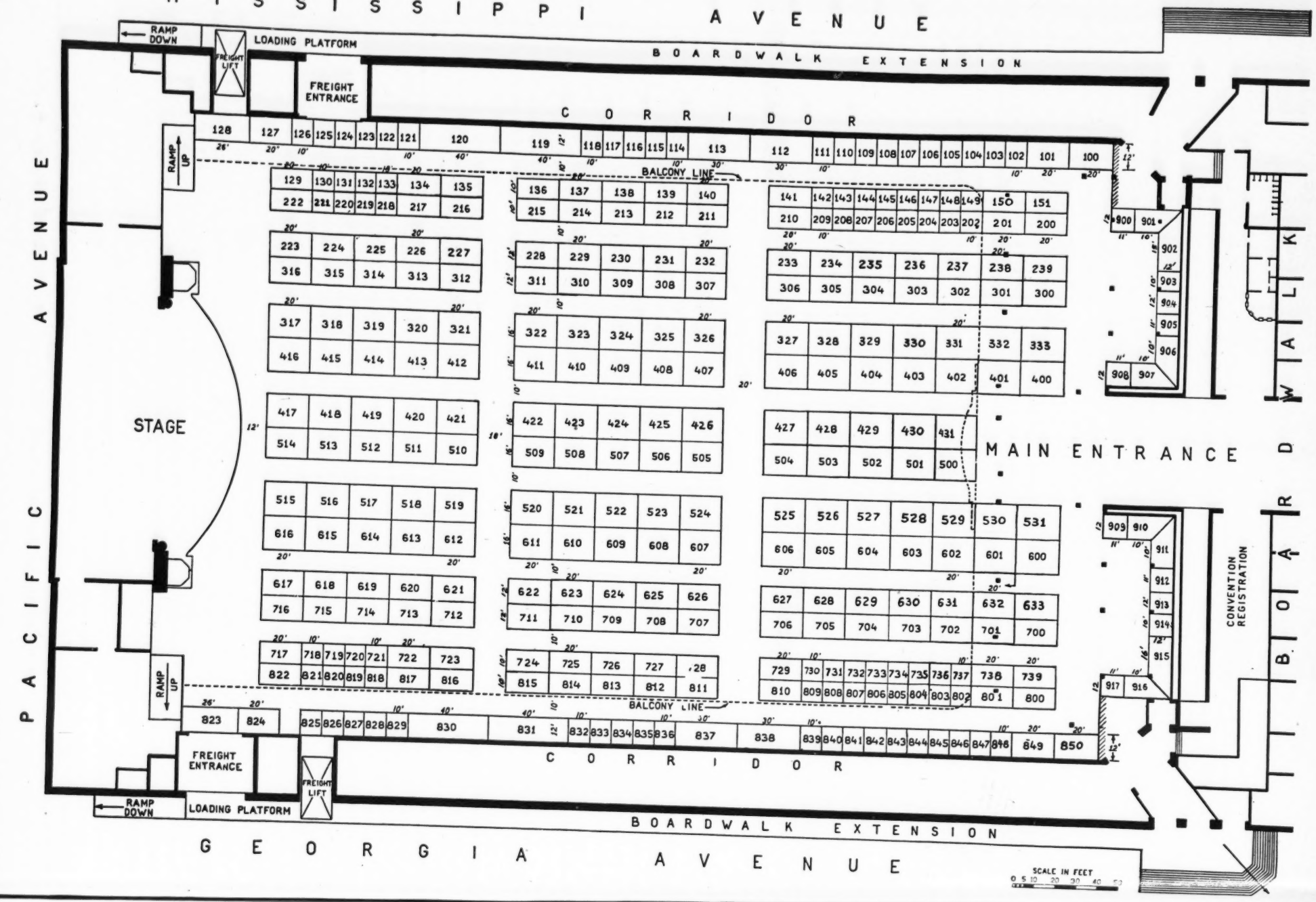
In operation this single point ignition system has four phases: (1) the "Off" phase, (2) the "Heating" phase, (3) the "On" phase, and (4) the "Cooling" phase.

The "Off" Phase. When the oven is not in use the thermostat valve (50) is off. The main gas valve (13), the stand-by pilot valve (15), and the heating pilot valve (51) are closed. The flash pilot valve (14) is open. No gas is flowing.

The "Heating" Phase. To start, turn the thermostat valve (50) "on" to desired temperature. Gas flows through valve (14) to the flash pilot (21) and also through valve (51) to the heating pilot (22). There is no gas, as yet, to the main burner (60) or stand-by pilot (23). Gas from port (21) charges the flash tube and is ignited at the top burner pilot (70) and propagates down to ignite at port (21) and hence around to a point at the burner, then to the ports of the heating pilot (22). The heat responsive element or bulb (11) is then being heated.

The "On" Phase. When the heat responsive element is heated through its operating range the expansion of the bellows (12) does three things: One, it opens the main gas valve (13), enabling the main burner (60) to receive gas which is lighted by pilot (22); two, it closes the valve (14) which turns off the flash pilots; three, it opens the valve (15) which sends gas to the stand-by pilot, which is lighted by pilot (22). This condition will continue to exist as long as the oven is on. This system does not affect the action of the oven thermostat in any way.

← *Layout of Booths*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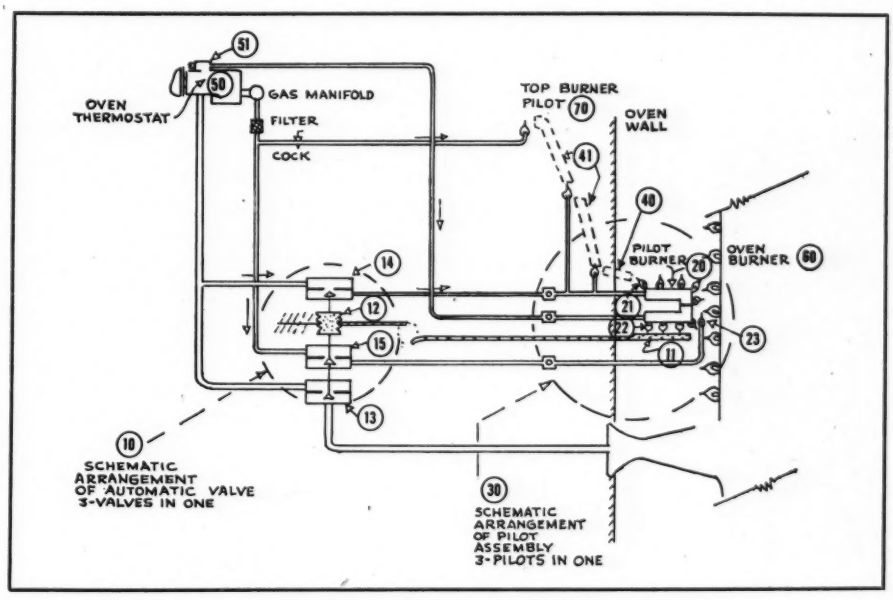

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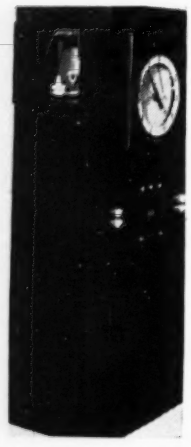
← *Layout of Booths*

The "Off" Phase. To turn the oven off, simply turn the thermostat (50) to the off position. The flow of gas is stopped to all points except the stand-by pilot (23). This will continue to burn, a short while, until the bulb (11) cools and closes the automatic valve (13) as well as the stand-by pilot valve (15). This arrangement gives the operator the privilege of turning the gas on and off at will without unburnt gas going into the oven. When the stand-by pilot valve (15) closes, the unit is ready for recycling.

Hardwick occupies booths 522, 523, 524, 607, 608, and 609.

Connelly Showcases Caloroptic Controller

The new Model 5 Caloroptic Btu controller will be a focal point of interest in the Connelly, Inc., display in booth 233.



This instrument incorporates the regular Connelly Caloroptic Btu indicator with a photo cell placed to observe the character of the gas flame. Energy from the photo cell is transferred to a Brown electric recorder-controller.

The latter instrument, when the Btu of the gas rises or drops within predetermined limits, energizes a motorized valve controlled by a special interrupter designed by Connelly. This mechanism corrects the mixture, thus bringing the Btu back to the desired level. The device provides butane and propane plants with completely automatic control and a charted record of Btu output.

The Connelly exhibit will also include the latest field data on gas purification, utilizing Connelly Iron Sponge.

Dash Pot for Disc-Type Check Valve Featured

In booths 841 and 842, Norwalk Valve Co. will be calling attention to its disc-type check valve equipped with the recently developed dash pot. A large valve will be mounted on a stand with the dash pot on the side of it so that it may be examined in complete detail and from all angles.

This type of valve is used to control the flow of gas or air or to prevent encroachment of air into gas lines when air and gas are used together and air pressure exceeds gas pressure.

When either gas or air is placed through the check valve with high velocity, the disc is liable to chatter. This objectionable feature is controlled by use of the recently developed dash pot. The dash pot also has the added advantage of slowing down the closing of the disc when an abrupt reversal of flow is encountered.

Hydro-Pneumatic Tester For Tin-Steel Meters

Superior Meter Co., Inc. is showing its new hydro-pneumatic testing machine for tin steel gas meters in booth 410. This unit features for the first time stainless steel tank and guide rods, as well as a specially developed chemical additive which is guaranteed to prevent rust formation on meters tested in the special aqueous solution.

Other construction details include the unbreakable Lucite reflector window with externally mounted lamp for greater life and easier maintenance; immersion mechanism that is fully air operated; pressure regulator of 2 to 5 lb range; built-in overflow; drain with drain screen to prevent clogging; positive locating head for the top gassing operation to prevent creeping away from the top gassing inlet.

The testing machines are available for final gassing or as combination units for final and top gassing. The standard size will handle 5 lt. and 10 lt. meters of all makes but testers for larger size gas meters can be made to order.

Automatic Ignition for Clothes Dryers Shown

"Matchless" performance — literally —will be seen in booths 141 and 142, where Hamilton's latest gas dryer models will be exhibited. No. 1100-G, latest in the Hamilton line, boasts completely automatic ignition, which Hamilton claims is the first on the market.

On this model, the user sets the timer and the dryer is "on"—there are no buttons to push or matches required for "matchless" performance. A small electric coil is energized, generating enough heat to ignite the gas at the pilot when the timer dial is turned on. The pilot then ignites the gas at the main burner.

The drum stops when the dryer door is opened, a special built-in switch acting to cut off the main burner and stop the drum. The pilot burns only when the dryer is in use.

The timer switch sets in motion five operations: it activates the automatic ignition, turns on the electric motor and fan, puts the drum in motion, governs the length of time the main burner is on, and permits the drum to continue to revolve for five minutes after the main burner is shut off.

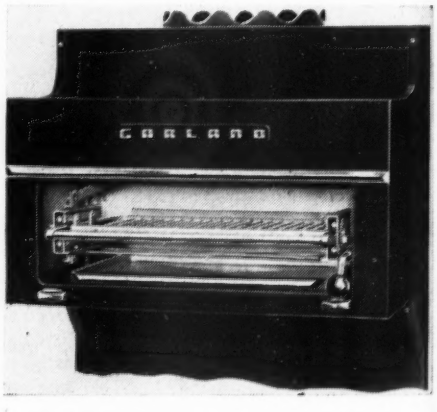
Fry-Top Range and Salamander Introduced

Detroit-Michigan Stove is displaying for the first time in booths 403-406, its new fry top range. This range features a griddle size 35½ x 35½ in., which is built of solid cast-iron and highly polished with raised edges consisting of 1½-in. high flange at the rear and ¾-in. high flange on both sides, giving extra protection against spill-overs. The frying surface at back is ¼ in. higher than at front, providing a natural slope toward the front for grease drainage into a large, easily removable container on the left front column of the range.

The top is heated by six tubular burners, paralleling each other from front to back. A separate valve for each burner adds flexibility and promotes greater economy. Two additional burners extending half-way across the front serve as lighter burners and aid in heat distribution. Burners are lighted automatically.

The oven measures 24 in. wide x 29 in. deep and 15 in. high, is equipped with oven heat control, heavily insulated and porcelain enameled for easy cleaning.

Another feature is a new salamander broiler and toaster with adjustable grid.



Salamander with adjustable grid.

This unit takes up no additional space inasmuch as it is designed to be attached to the top of a series 29 range in a similar manner as a high shelf. It is ideal for kitchens where large broiling units are not required; provides increased broiling facilities where new capacity is necessary; or where space is

a limiting factor. It is heated by two multi-port cast burners equipped with ceramic radiants. At the front right is convenient lever for raising or lowering grid to suit operator.

Detroit-Michigan will also show the new "Dinette" (see *GAS*, September, p. 64).

Varied Exhibit Features Conversion Burner

Diversity will be the keynote of Surface Combustion Corp.'s layout, spread over four booths—228, 229, 310, and 311.

Everything from domestic space heaters to gas production machinery, and including commercial heating appliances, industrial furnaces, and Kathabar air conditioning equipment, will be on view.

A standout among the line of Janitrol models of conditioners, conversion burners, unit heaters, gravity furnaces, boilers, and "triple-service" units will be the newest development—an eye catching conversion burner model.

With all parts totally enclosed in a blue enamelled case, the latest Janitrol concentrates fewer parts into half the space and weight of previous models through ingenious combining of features and functions.

New features include a solenoid valve and regulator combination and an electric-spark pilot lighter. Sample simplification is the elimination of primary air shutter by merely telescoping the venturi into the burner tube for air adjustment and the extension of the burner to the desired location in firepot.

In its showcasing of production equipment, Surface will utilize new techniques to tell the story of catalytic cracking for peak shaving and base load.

Gas Generator Oil-Gas Apparatus on View

Two recent developments of the Gas Machinery Co. will predominate in displays at the Cleveland company's booth 239.

The continuous gas generator, a tubular furnace employing silicon carbide tubes, and using natural gas, LP-Gases, natural gasoline, or straight run gasoline as process feeds, will be the prize exhibit.

New construction projects of this continuous catalytic generator are now under way. These projects are based upon two years of experimentation and development. Previous to this, the company had employed and continues to use silicon carbide tubes of the same type in industrial gas furnaces. These tubes are made in sections with provision for expansion and thermal shock. The essential feature of this arrangement is the ball and socket joint, which was specifically developed by Gas Machinery for this purpose.

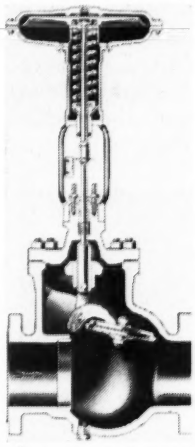
Also on view will be the new oil gas apparatus designed expressly for use with heavy, low-cost oils.

(Further data on both of these processes will be found in *GAS*, Jan. 1950, p. 31, and Nov. 1949, pp. 29-33.)

Information on many other processes and services will also be available at the booth.

Meter Run Valve, New Regulator Displayed

Among the new improvements in equipment to be shown in the Fisher Governor booth will be an improved meter run valve. This new Type 57TL, says Fisher, fills a long-felt need for a metering station valve which will provide absolute shut-off when closed and negligible pressure drop when open. Of unique design around known and tested principles, the 57TL meter run valve is actuated by a powerful diaphragm motor responsive to the sendout of a differential pilot valve in the orifice meter. Installed in the secondary runs of multiple tube meter stations, the Type 57TL functions to place the secondary meter runs in and out of service automatically as the total flow increases and decreases.



Another product to be spotlighted in the Fisher booth (308) is the "time-temperature" gas pressure booster regulator, a handy piece of equipment for utilities taking on new househeating loads, which senses a drop in outside temperature and automatically increases the sendout pressure to compensate for the increased demand. This booster has a timing mechanism which restrains boost in pressure during night hours. The Fisher-King booster regulator will also be shown, as will a new house service regulator, the Type 735, which is equipped with a magnetic safety mechanism to guard against excessive appliance pressure without the conventional venting of gas to the atmosphere.

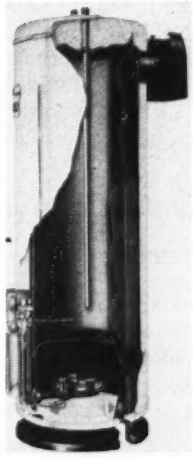
Koppers Builds Around Unified Service Plan

Koppers Co. Inc. will be emphasizing its services rather than its products in booths 710 and 711. Displays will feature its unified program of gas industry consultation, design, manufacturing, construction, and maintenance service.

This new type program was inaugurated late in 1949 by Koppers engineering and construction division as an answer to the needs of utilities, communities, and industries in their plans for modernization, expansion, and operation under changing conditions.

In the GAMA display, Koppers will describe the new service and illustrate equipment which it is prepared to manufacture, erect, and place in operation, including catalytic reforming units, fuel bed reforming installations, liquid petroleum plants, high Btu oil gas sets, high pressure boilers, storage facilities, pumping stations, and auxiliary equipment such as condensers, purifiers, scrubbers, precipitators, exhausters, compressors, and oil fogging apparatus.

"Heatwall" Spotlighted In Smith Display



Among the many articles of interest in the A.O Smith booths —138B, 139, 140, 211, 212, and 213B—will be the new 1950 Permaglas line: 20-, 30-, and 45-gal. water heaters with the glass-lined "Heetwall" replacing the customary center flue with flat exhaust column at the back.

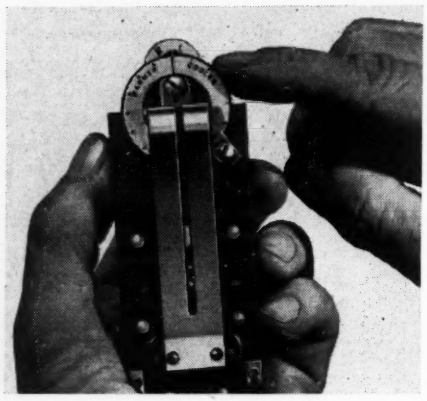
With all hot gases being confined in a thin sheet directly against heat-absorbing surfaces at the bottom and rear of the tank and 38% greater heating area being presented, more effective, faster heat transfer is claimed possible.

"Warmer-Cooler" Dial New Thermostat Device

A new idea in thermostatic controls will be shown in booths 200 and 201A, where Perfex Corp. will take the wraps off its novel "warmer-cooler" temperature dial. This new dial, which permits the user to "tune in" heating comfort

instead of selecting a certain degree setting, is now being made available optionally on the company's Magic Dial thermostats.

The company claims that the new item will help to reduce troublesome service calls resulting from disagreement between dial setting and thermometer reading. By use of the Magic Dial thermostat, "roller - coaster" temperature changes are effectively eliminated and a heating system can be operated as though tailor-made for an individual home. The heat flow is automatically controlled to provide the proper amount by permitting variance of the length of time the burner operates. For example, set at "S" (short "burner on" periods), the burner operates at short intervals; set at "L" (long "burner on" periods) it operates for long intervals with a full range of adjustment between.



"Warmer-cooler" temperature dial.

Cyclic Catalytic Gas Process To Be Shown

The UGI cyclic catalytic reforming process described in February 1950 *GAS* (pp. 26-29) will be demonstrated at the United Engineers & Constructors Inc. booth (610 and 611).

Engineered for base load production with natural gas or peak load production with LP-Gases, the process has the flexibility to produce gases of characteristics required for interchanging with existing gas mixtures. It has been thoroughly tested on plant scale production apparatus and several large units are currently under construction. The investment cost required is low since modifications of existing gas generating equipment or installations of new units feeding into an existing gas train is practical and economical. Production costs with the process are lower than fuel bed reforming since the use of solid fuel is eliminated, since the efficiency of the process is high, and since high capacities are available with a minimum of labor.

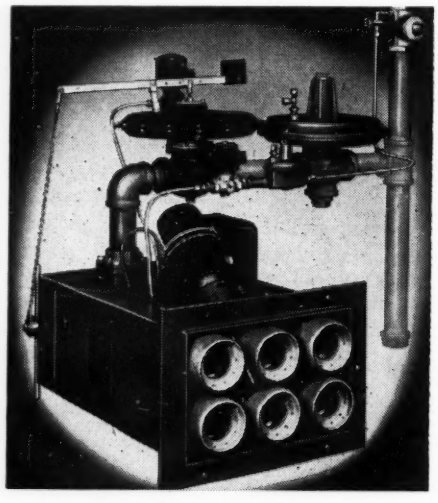
A model of the gas production apparatus for the new process will be on display. To the viewer the apparatus will appear as a dramatically colored cross-section which changes to illustrate the process.

Commercial Conversion Burners Featured

Eight booths have been taken over by Bryant Heater Division of AGE to show off its varied wares: 429, 430, 431, 431A, 500A, 500, 501, and 502.

Newest development is the Model 1400 Multi-Torch conversion burner. Commercial burners in seven models with capacities ranging from 400,000 to 1.5 million Btu-per-hour input, Multi-Torches are designed especially for ash-pit installation in apartment houses, churches, and office buildings. They are completely automatic, and operate smoothly, producing a soft, bushy flame claimed to be ideal for gas firing all types of up-draft boilers and furnaces.

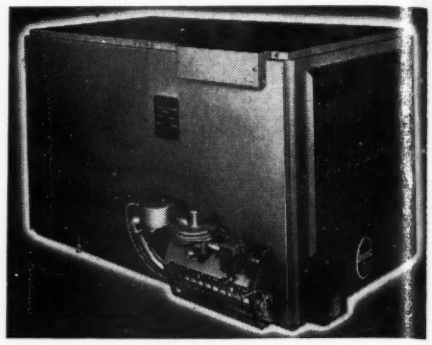
Shipped complete in one package, Multi - Torch assemblies consist of a group of injector torches (3 to 12) attached to a cast manifold and enclosed in a sheet metal duct. A spark ignited pilot, ignition transformer, diaphragm gas control valve, automatic air door, and electronic safety cutoff complete the standard equipment on the assembly. The control components are self-checking during each cycle of operation.



"Multi-Torch" conversion burner.

The Model 324 winter air conditioner will also be spotlighted. This furnace, designed for attic installations where space is a determining factor in selection, has a flexible mounting assembly which permits under-floor suspension.

Burning any type of gas, it is available in either 100,000 or 125,000-Btu capacities. Shipped intact in a single assembly, it may be separated to facilitate handling and installation. The front section contains exchanger, burners, controls, and draft hood; the rear houses blower, blower motor, and filters.



New winter air conditioner.

The Model 365 floor furnace will also be prominently displayed. (Introduced to the trade last spring, it was described in May *GAS*.)

Other Eye-Catching Exhibits Planned

Another manufacturer who will be accentuating gas conversion burners is American Radiator & Standard Sanitary Corp., whose Stanflame—announced in the March 1950 issue of *GAS*—will be the featured display in the company's area—booths 407, 408, and 409.

Other products to be shown are the Empire boiler, Navaho floor furnace, Mohawk and Wyandotte winter air conditioners, Sunrad radiator, Multifin convector, "RC" Type baseboard radiant panels, and Budget water heater.

Taking over the stage at the end of the hall, Servel will display its water heaters, refrigerators, and all-year air conditioners. Servel has developed new models in every line since the last GAMA show, held two years ago in Atlantic City, so will have a number of products to present.

Promising to catch the eye of many visitors are the air conditioners, introduced early this year, which are merchandised under an "increment" scheme which permits the installation of basic units, to which supplemental units may be added.

Cutaway models and an animated display will be special features of the Vulcan Rubber Products Inc. exhibit in 218 and 219.

Meters, regulators, and controls using Vulcan diaphragms will be shown.

Featured in booth 330 will be Reynolds Gas Regulator Co.'s pressure loading regulators. These loaders can be applied to flanged toggle regulators in any of the larger sizes.

Selecting An Odorant For Natural Gas

Part I of a two-part article

By J. S. POWELL

The person or persons responsible in a utility for the selection of an odorant find that complete and reliable technical information on the essential properties of commercial odorants does not exist and that procedures for obtaining this information have not been published. It is the object of this discussion to aid in the correction of this situation by making available information and procedures to be used in the selection of an odorant for natural gas odorization.

THE requirements an ideal odorant should meet are as follows:

(1) It should be chemically stable in a gas transmission and distribution system so that no loss in the odor strength of the odorant would occur due to chemical change on the passage of odorized gas through the system or through soil in the case of gas leakage.

(2) It should be non-corrosive to storage tanks, injection equipment, and pipelines.

(3) Appliances utilizing gas odorized with the odorant should not be adversely affected in any manner as the result of the presence of the odorant, such as through the corrosion of appliance parts and the formation of deposits in gas passageways.

(4) Under the pressure and temperature conditions in a gas transmission and distribution system condensation of the odorant should not occur.

(5) It should have sufficient odor strength so that the quantity of odorant to be transported, stored and injected would be practical and the cost of odorization reasonable. Also the physical nature of the odorant should be such that it can be readily injected into the gas.

(6) It should have a characteristic odor so that the odor of the odorized gas would not be confused with other odors common in dwellings. The odor should be neither highly obnoxious nor pleasant.

(7) The gas odorized with the odorant should not be toxic on account of the odorant or be dangerous or damaging in any way. Also the combustion products from the odorized gas should not be toxic, odorous, irritating, nor otherwise objectionable because of the presence of the odorant.

All of the odorants which are commonly used are organic sulfur compounds being essentially a pure sulfur compound or a mixture of sulfur compounds. The main reasons why organic sulfur compounds have been selected for odorants are that these compounds have a characteristic odor, are not pleasant smelling, and in this category are the most odorous substances known. It is unfortunate that this is the case because the sulfur in these compounds is responsible for their undesirable properties. If carbon and hydrogen or carbon, hydrogen, and oxygen compounds could be found with suitable odor characteristics, the ideal odorant might be discovered.

In this report only the types of sulfur compounds found in the various commercial odorants have been evaluated with respect to the previously listed requirements.

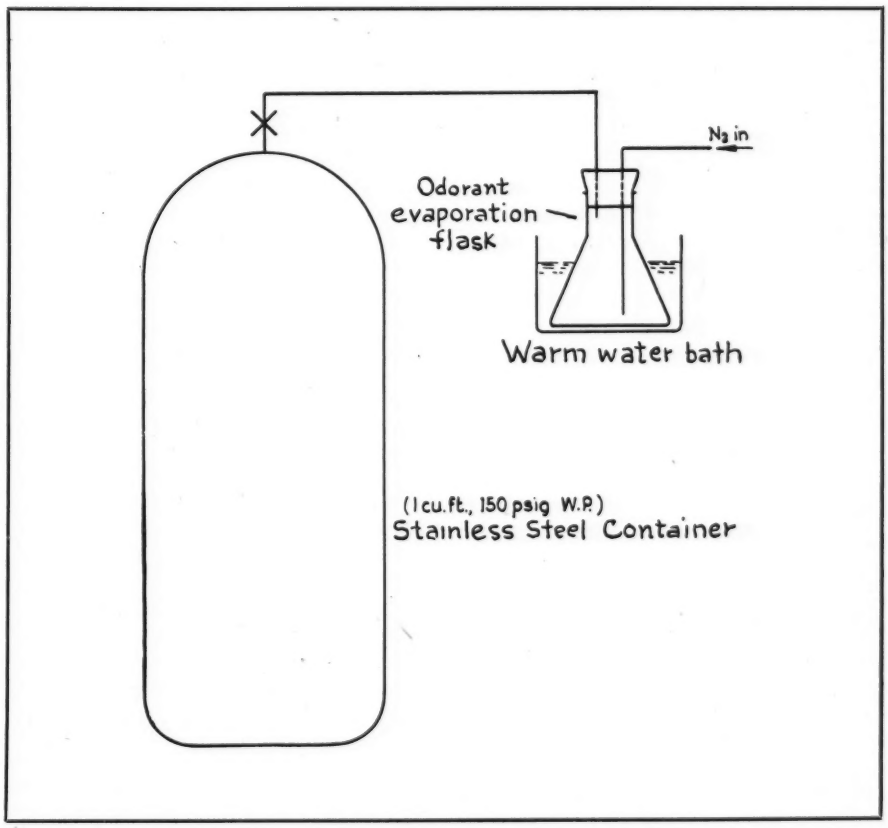


Fig. 1. Apparatus for preparing standard odorized nitrogen.

Mr. Powell is research engineer, Southern California Gas Co., Los Angeles. This paper was first presented at the 1950 PCGA technical services conference, San Diego.

The commercial odorants now available contain singly or in combination mercaptans, disulfides, thioethers, and compounds with sulfur and carbon in a ring. The odor strength of these types of sulfur compounds increases in the following order:

Disulfides
Thioethers
Carbon-sulfur ring
Mercaptans

The order of chemical stability increases as listed below:

Mercaptans
Disulfides
Thioethers
Carbon-sulfur ring

Mercaptan Odorant: It will be noted that the mercaptans have the greatest odor strength and least chemical stability. Mercaptans are oxidized readily by oxygen in the presence of iron oxide to disulfides, the type of sulfur compound in the list above with the least odor strength. The oxidation of mercaptans to disulfides in a gas transmission and distribution system will take place even with very low concentrations of oxygen in the gas. With the concentration of the oxygen equal to or greater than the theoretical amount necessary for the reaction (0.0004% oxygen per grain of mercaptan sulfur per 100 cu ft of gas) the completeness of the reaction is limited by the residence time of the gas in the system and the catalytic activity of the iron oxide which is found on the walls of all pipelines.[1]

Rapid Oxidation

In a pipeline system where a mercaptan type of odorant is being used for the first time, the oxidation of the odorant may be rapid and complete for several weeks. However, the iron oxide on the pipe walls gradually loses its catalytic activity, and eventually the degree of oxidation becomes quite small. Nevertheless, it would be expected that some oxidation would take place permanently since there would be the continuous formation of new iron oxide by the internal corrosion of the pipe, and the replacement and addition of new pipe in the system would afford some new catalytic surface.

Mercaptans are very weak acids and will react with strong bases to form mercaptides; they also will react with heavy metal salts to form insoluble metal mercaptides according to the following reactions:

$$RSH + OH^- \rightleftarrows RS^- + H_2O \qquad (1)$$

$$2RSH + Cd^{++} \rightleftarrows Cd(RS)_2 + 2H^+ \qquad (2)$$

Therefore, wherever a gas odorized with a mercaptan would come in contact with a strong alkali, a heavy metal salt, or the two together for the most effective reaction condition, some or all of the odorant would be removed from the gas. Consequently, it would be expected that a gas odorized with a mercaptan odorant in passing through an alkaline soil containing heavy metal salts might lose all or part of the odorant by chemical action. All sulfur odorants depending on the conditions are removed partially or completely from gas passing through soil by the physical adsorption of the odorant by the soil, and it is therefore difficult to determine in the case of a mercaptan odorant whether physical adsorption or chemical action is the main cause of odorant loss. In any event a gas odorized with a mercaptan odorant in leaking from a pipeline and passing through soil may have its odor intensity reduced by the following three possible actions:

(1) Physical adsorption of the mercaptan by the soil.

(2) Chemical absorption of the mercaptan by the soil constituents.

(3) Oxidation of the mercaptan to a disulfide in the presence of the soil.

Three Actions

Disulfide Odorant: Disulfides are quite chemically non-reactive. They do not react with strong bases or heavy metal salts as do mercaptan or are they oxidized at atmospheric temperatures by oxygen. They can be reduced quite readily to the parent mercaptans and are apparently reduced at times under conditions which can exist in pipelines[1]. It is not known exactly what these conditions are, and it is doubtful whether they do exist very frequently in pipeline systems. Reduction would probably only take place when a disulfide type of odorant was being used for the first time in an old system and for odorizing a gas containing no oxygen. Oxygen in the gas would most likely prevent any reduction from taking place. In any case where reduction did occur, the intensity of the odor of the gas would increase.

Thioether odorant: Thioethers are very chemically stable, and for use as odorants they should meet all requirements for chemical stability.

Odorant with carbon and sulfur in ring: These cyclic compounds are the most chemically stable of all the sulfur compounds and in this respect are the most ideal as odorants.

None of the sulfur compounds used as odorants is significantly corrosive in the liquid state to the metals used in the construction of odorizing equipment under the conditions which usually prevail. Copper, although not commonly used in the construction of such equipment, is a metal that was found to be corroded slghtly by all of the representative liquid commercial odorants tested; corrosion products were produced which in most tests formed some sediment in the odorant. It is likely that this corrosion in some cases may not have been caused by the sulfur compound or compounds of which the odorant is mostly composed but by other constituents in small concentrations, such as hydrogen sulfide.

TABLE 1: CORROSION OF COPPER AT 800°F IN 16 HOURS BY OXYGEN-FREE NATURAL GAS ODORIZED WITH VARIOUS ODORANTS

Odorant Designation	Type	Concentration of Odorant Sulfur Grains/100 cu ft	Sulfur Combined With Copper mg./sq in.
A	Mercaptan	one	1.9
B	Mercaptan	one	1.1
C	Thioether	one	0.4
E	Carbon-sulfur ring	one	0.04
F	Thioether, disulfide, and carbon-sulfur ring mixture	one	0.4

Will It Corrode?

Before using an odorant it would be well to determine if it will corrode the metals from which the odorizing equipment is constructed. This can be simply done by placing coupons of the construction metals in the liquid odorant and after several weeks observing whether any corrosion of the coupons

has taken place. The coupons may be weighed before and after their exposure to the odorant to determine how much corrosion has occurred. Any corrosion is undesirable since even if the loss of metal is not significant, the corrosion products formed may interfere with the proper operation of the odorant injector.

None of the sulfur compounds in the commercial odorants in the concentrations used for natural gas odorization at normal atmospheric temperatures is corrosive in the vapor phase to pipeline metals including copper. Some of these odorants may contain a trace of hydrogen sulfide which will tarnish copper.

The representative odorants tested in the concentrations recommended for natural gas odorization all slightly corrode copper and copper bearing alloys, of which appliance pilots are commonly constructed, at the elevated temperatures that pilots may reach by being in close proximity to the main appliance burner; aluminum is not affected. The degree of corrosion increases in the order of the following listed types of odorants:

Carbon-sulfur ring
Thioether
Disulfide
Mercaptan

This relationship is indicated by the data in *Table I* which gives the results of corrosion tests made by maintaining for 16 hours polished copper coupons at a temperature of 800° F in a stream of oxygen-free natural gas containing separately each type of odorant in a concentration so as to give about one grain of sulfur per 100 cu ft of gas.

Analyzing Deposits

The formation of corrosion products in appliance pilots is objectionable in that they accumulate and eventually extinguish the pilot by the closure of the gas passageway. The analysis of such deposits shows copper sulfides to be the principal constituents. However, it has been found that the small concentrations of oxygen in natural gas introduced sometimes during transmission operations will corrode copper at elevated temperatures at a rate comparable with that obtained by any of the odorants in oxygen-free natural gas. Preliminary tests have indicated that when an odorant and oxygen are both present together in natural gas the rate of corrosion of copper may be considerably greater than the sum of the corrosion rates of copper in natural gas containing oxygen and the odorant separately[2]. It has been found that deposits causing plugging of copper pilots operated on odorized gas containing oxygen consist of both copper sulfides and oxides.

Therefore, if oxygen is present in natural gas, it would be expected that even if the gas were odorized with a non-corrosive odorant some stoppage of pilots would occur. However, a corrosive sulfur odorant also present in the gas might increase greatly the frequency of pilot stoppage, and the frequency might vary considerably depending on the corrosivity of the odorant.

Stoppage Test

The effect of different odorants on pilot stoppage frequency is indicated by the results of a test with a floor furnace which was conducted as follows. Duplicate sets of 15 pilots were placed on each side of the floor furnace burner. In each set there were three each of five different types of pilots and each of the three pilots of one type was placed at a different distance from the burner. One set of pilots was operated with natural gas odorized with a mercaptan type of odorant (Odorant B) and the other set with natural gas odorized with an odorant (Odorant F) which is a mixture of thioethers, disulfides, and carbon-sulfur ring compounds. The natural gas contained only a low concentration of oxygen which varied from a few tenthousandths to a maximum of a few hundredths of a per cent. The furnace was operated continuously. Listed below is a summary of the results obtained.

Months of Operation	*Per Cent of Pilots Plugged*	
	Odorant B	*Odorant F*
5	33	None
10	48	27
17	48	27

It is essential that an odorant be sufficiently volatile so that it can be completely vaporized into the gas stream at the required odorization rate and not condense from the gas at the lowest temperature and highest pressure encountered in the system. If the odorant is composed of one or more compounds and the percentage, molecular weight, and vapor pressure of each of these compounds is known, the maximum quantity of odorant which a gas will hold can be calculated under any pressure or temperature conditions.

Procedure

A procedure for making this calculation is as follows. Establish the lowest temperature and highest pressure condition which the gas to be odorized will be subjected to in the system. Then for each component of the odorant, assuming it to be the first constituent to condense from the odorized gas, substitute in the following equation and calculate the quantity of odorant the gas will hold.

where: $Q = \dfrac{264{,}000\ p\ M}{w\ P}$

Q = pounds of odorant per MMcf
M = molecular weight of component
p = vapor pressure of component at lowest operating temperature in psia
w = weight per cent of component in odorant
p = highest operating pressure in psia

Take as the actual quantity of odorant that the gas will hold the smallest quantity thus calculated.

Often commercial odorants even though they may contain only one major constituent are complex mixtures of compounds, and the complete composition and the properties of the constituents are not known. If such is the case, it is not possible to calculate the maximum quantity of odorant that the gas will retain especially if the unknown constituents are the highest boiling.

Composition Test

The complexity of the composition of an odorant and its volatility can be judged from the results of an ASTM distillation. A large boiling range and a non-uniform change in boiling point with per cent distilled indicates the odorant is of complex composition. The quantity of the odorant which can be completely vaporized in a gas will be limited most likely by the high boiling constituents present. The distillation indicates the presence of such high boiling constituents by a progressive increase in boiling point as the end of the distillation is approached; the higher the distillation end point the less volatile the odorant.

In the case of an odorant with a complex composition the maximum quantity of odorant that can be held in a gas can best be determined experimentally by vaporizing various known amounts of the odorant in the gas at atmospheric pressure and determining the odorant dew point temperature in each case. On semi-log paper a plot of the quantity of odorant per MMcf on the logarithmic scale against the reciprocal of the absolute dew point temperature on the arithmetic scale will give a straight line; at a given temperature the quantity of odorant per MMcf will be inversely proportional to the absolute pressure of the gas in which the odorant is being vaporized, therefore lines for any pressure can be drawn parallel to the atmospheric pressure line. The performance of the experimental work to obtain data for the preparation of such a chart is quite difficult, and usually it is not necessary since the supplier of the odorant may have prepared a volatility chart for his odorant which he will make available.

Bibliography

(1) Powell, J. S., *Proc. of the Pacific Coast Gas Assn.*, *40*, 192-193 (1949).
(2) Kruger, H. O., *Ibid.*, 201 (1949).

CLEANING MAINS

How a Michigan utility stopped pressure drops and increased sendouts at 30% of replacement costs

By J. K. Tolford and G. L. Wigglesworth

SMALL BRUSH has just made a pass through the line in the photo above. Also visible: the connection of the cleaning rod to the brush and to the pulling cable. At left are displayed the various tools and equipment used in the main-cleaning operation by Citizens Gas Fuel Co.

OUR distribution system had originally been constructed for manufactured gas and after converting to natural gas the load increased to the extent that, although the initial manifold pressure was materially increased and was controlled by a "round the block" control, certain areas experienced extremely low pressures under heavy load. As this had been originally manufactured gas, it was assumed that some of the mains might be partially plugged with dirt. This was substantiated by extensive pressure surveys taken, first, over a comparatively large area and gradually narrowed down until by the end of the peak load winter season we had a map of this area on which the mains, found to be dirty, were marked in red.

In some cases this might be a section of main four or five blocks long, in others for only a half of a block. In some cases the obstruction was found to be only a few feet in length and was apparently caused by some unusual condition or obstruction from which a dirt drift had started. In the cleaning operation we found that the actual obstructions fitted very closely, both in location and intensity, with the information we had compiled from the pressure surveys.

The primary pressure survey covered an area which was served by approximately 60 miles of main from 2-in. to 8-in. in size and it was determined early that the mains which were causing difficulty were, in general, in the vicinity of the former manufactured gas plant. Intensive surveys in this area indicated that it would be advisable to clean or replace approximately 1¼ miles of main the first year.

It was our opinion that it would be much less expensive to clean these mains than it would be to replace them; the following summer this cleaning was done. We now have gone through another winter season and found that the results of the cleaning were as follows:

Previous to cleaning the mains the capacity of the control station serving this area was 70 MMcf per hr with a manifold pressure of 30 in. of water column. The conditions at this station were such that it was not advisable to greatly exceed this 30-in. pressure which resulted in a maximum capacity output of approximately 70 MMcf per hr, although it was necessary to exceed this somewhat on peak days. After the main cleaning was done we had a delivery from this station of 90 MMcf per hr with a manifold pressure of 22 in. It is our opinion that we will be in a position to send out between 100 MMcf and 110 MMcf per hr if necessary. From the above figures it would appear that the main cleaning now completed has increased the station capacity by approximately 50%. Surveys made this past winter indicated some additional spots which should be cleaned. These were marked on a map and are to be done when there is further need for more capacity.

The equipment used was:

1½-ton truck with a winch
Compressor
Sewer rod (Flexicrome 5/16 — 3-ft sections)
Brushes and augers 2 in. to 6 in.
A three- or four-man crew.

Preparation

Select a section of main that has been scheduled for cleaning or replacement and check the records as to size, age of pipe, ground conditions and general maintenance experience. If the main is estimated to be in fairly good physical condition (10 to 20 years of remaining life) a sketch is prepared showing where street openings are to be made at intervals of 200 to 300 ft depending upon field conditions.

Excavate two holes down to the main and tap the pipe for bagging off; then notify the customers concerned that they will be out of service for the following day.

On the next day (a clear day) bag off as early as possible and begin cutting a 3 or 4-ft section of main out of each hole. Put a blank Dresser coupling on the live ends and remove the bags. (The section chosen to be cleaned must be fed from both directions or a by-pass installed.)

Have men shut off the cock at each house and disconnect the inlet side of

Mr. Tolford is general superintendent and Mr. Wigglesworth is engineer, both of Citizens Gas Fuel Co., Adrian, Mich.

the meter in the section of the main being cleaned.

First insert the rod with nothing attached. When it emerges at the opposite end attach a small auger to the rods and then the cable in such a manner that it may be pulled back in the event that it becomes stuck. As soon as the auger or brush is pulled a foot or two into the pipe, insert the compressor hose and begin free air blowing through the main. Fill the end around the hose with rags to prevent the air from blowing back. This air is important. It keeps the dirt loose around the brush or auger. Care should be taken to keep the discharge end of the main clear of obstructions so as to eliminate any possibilities of excess pressure building up in the main and also to allow a free flow of air and dust from the main.

Continue putting augers and then small brushes through until a full size brush can be put through with no trouble and only a little dust results when the air is applied. A truck or tractor will make the rod pulling easier.

The rods are pulled in one direction only, with the brush or the auger, and then returned without the brush or auger by pulling the cable from the opposite end. The main object is to move the dirt in one direction by mechanical brushing and flowing air.

Finishing Up

After the main is determined clean each service is blown toward the main, after which the final pass is made with the brush prior to closing up the main and putting it into service. Cocks in the customers' homes should be closed at all times other than when the service is blown out, using the compressor.

After the gas is put back on, and the main purged, the service department is notified, and all customer appliances relighted.

The usual Dresser couplings are used to put the main together. Sometimes new sections of pipe are necessary as the old pipe may look bad in that particular spot or it may be desirable to remove an old coupling, cast iron bell, etc. Opportunity should be taken to examine the pipe and if possible a glass disc should be put at the live end of the main to observe the uncleaned pipe. With some experience of observing the pipe through a glass with a good flash light, one can determine which is dirty, and which is not. Safety glass between two Dresser coupling gaskets is recommended. These observations will help in determining the distance main cleaning is necessary.

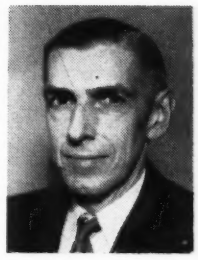
Discussion

When we started cleaning we found it advisable to have a full day set aside to clean, as complications may arise. If no trouble results the men can probably close one hole and put another down in the time left.

We have found several types of dirt in our mains. Some is a dry brown powder, another is a black granulated dirt, and still a third is an oily mush which apparently resulted from oil fogging. In cleaning 6-in. pipe we found the air was not as much help as in smaller size pipe. We found in cleaning the oily mush type that a rag over the brush helped considerably. We later tested this section for a low spot and found none, so apparently oil accumulated here as a result of a dirt dam. Where we cut into a main we always attempted to remove any cast iron bells or threaded coupling.

One of the problems encountered in our early attempts at cleaning was that the tools became blocked in the pipe. When this occurred it was necessary to locate the tool and open the main at this point and remove it. Care should be taken to start with small augers and brushes and gradually increase the size until a full sized brush can be used. The use of air as previously noted is very beneficial under these conditions. This also gave us information where mains were of a different size than that shown on the records. Notes were made of this and the records corrected. At all times we made notes on the condition of the pipe before cleaning and how it looked through the glass. We also indicated in our main book approximately the amount of dirt removed and the kind. This, we believe, will help in the future when other sections of main in that area are found to have an excess pressure drop.

The whole basis of our main cleaning is a complete set of pressure surveys taken at the peak hour load on the system. We not only took many pressure surveys on low pressure mains, but also on our high pressure mains. We used an eight-man crew on cold mornings at our peak hour from 8 a.m. to 9 a.m. These surveys were plotted on a map and are the basis for our main cleaning, and this year the installation of a new high pressure supply line.



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G. L. Wigglesworth

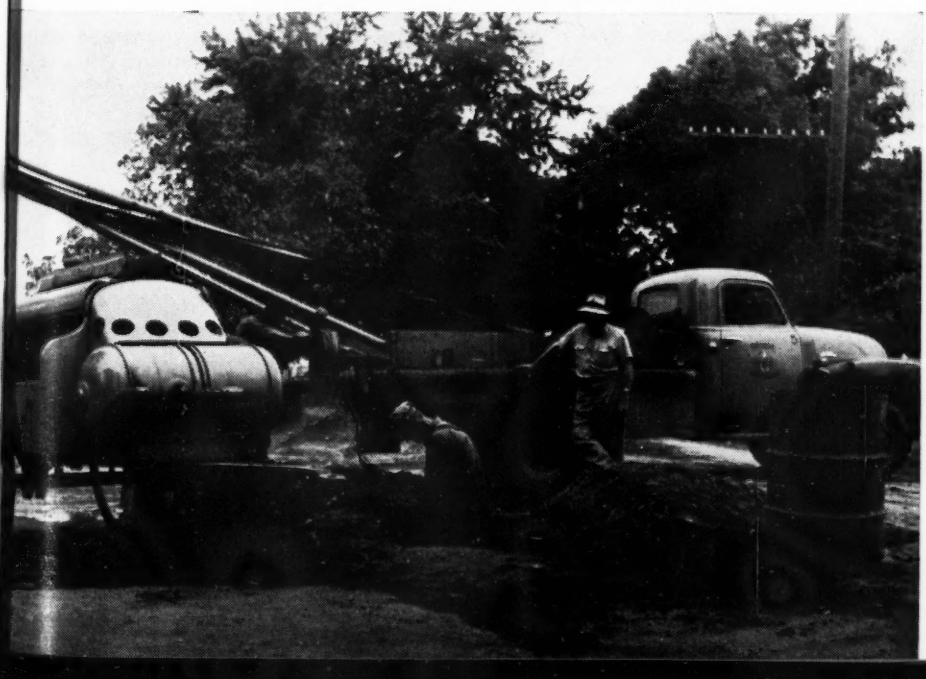
Cost

On careful examination of the pipe cleaned it was estimated that the average remaining life was well in excess of 50% of that of new pipe. The total cost of cleaning was less than 30% of the estimated cost of replacement. In one particular case a section of main which had been in service for nearly 40 years was cleaned. We estimated that this pipe would last another 20 years. The estimated cost of replacement was $1.50 per ft and the cost of cleaning 40 cents per ft.

It is our opinion that if proper surveys are made, comprehensive studies and conclusions can be obtained which make main cleaning economically sound.

It also has the advantage of presenting information of system flow to be used in sizing pipe in case replacements are necessary.

CLEANING BRUSH and rods are about to enter main in photo below. Also shown are compressor and cable reel, holding return cable.



A Comparison Between Atmospheric and Forced Draft Burners

By James M. Kobabe

ONE trend among larger boiler manufacturers is toward the use of forced draft in the design of high-capacity steam generating equipment. Leading, progressive consulting engineers also consider these factors when designing modern steam generating plants. The use of forced draft is favored because it is the only positive control of air supply for efficient combustion. This will be shown through an application of basic fundamentals pointing up a comparison between forced draft and atmospheric burners.

Exclusive

The prime requisite in any flow system is sufficient pressure drop across the system to overcome internal resistance and produce adequate flow. In a comparable heating system, the removal of waste gases produced by the combustion of gas with air is facilitated through the application of a "draft" or pressure differential to overcome flow-induced pressure losses.

Total pressure drop or loss through a boiler setting is a summation of the losses caused by several effects. Frictional resistance of the passageway surfaces against the flow of gases is generally the main source of pressure loss. Energy loss caused by general turbulence within the gases when making an abrupt change of direction is another. Sudden expansion or contraction of the gas passageways causes still more energy loss in waste eddy currents. This total pressure or draft loss through a setting will vary with the boiler design and the load under which it is operating.

Conceivably, in its simplest sense, draft could be applied to overcome the loss and produce flow either by raising input pressures in excess of atmospheric or by lowering exit pressures below atmospheric. In either manner, the flow of gases is aided by their volume contraction as they cool in the process of transmitting heat.

Forced draft in the form of a blower furnishing combustion air is used to raise input pressure. Natural draft through the use of a stack or induced draft through the use of a fan is applied to the waste gases to lower exit pressures below atmospheric.

A forced draft application requires only enough stack effect to overcome boiler draft loss and hold a zero firebox. In some instances, the stack effect of the boiler height itself is sufficient to overcome its own losses under moderate load. However natural draft alone requires not only enough stack effect to overcome boiler draft loss but an additional amount to produce negative firebox pressures capable of inducing sufficient air flow into the firebox.

Some large boilers are designed to operate under moderate positive pressure employing forced draft burners. Most boilers, however, are designed to operate under negative-to-zero firebox pressures according to whether natural or forced draft burners are used. It is the application of the combination of forced and natural draft to cover the latter category with which this article is primarily concerned.

Firebox Boiler

To best illustrate the ensuing discussion, consider a typical firebox boiler rated at 100 boiler horsepower and operating at 150% of its rated capacity with a fuel input of about 6 Mcf per hour of 1000-Btu natural gas. A conservative pressure drop across each boiler pass would be .10 in. water column.

Fig. 1 shows this boiler fired from an atmospheric gas burner of good design requiring a firebox presure of -.10 in. wc to introduce sufficient air for complete combustion. It then follows that the stack must supply -.30 in. wc draft.

Fig. 2 shows the same boiler under the same load fired from a forced draft gas burner against a firebox pressure of 0 in. wc. Figuring identical presure drops as before, the stack must supply -.20 in. wc draft. Thus only two-thirds the draft or stack height is necessary employing the forced draft burner for this representative boiler and load.

A material reduction in stack height is seen through the use of the forced draft principal without sacrificing a so-called "safe" furnace pressure. This reduction represents not only a saving in initial material and labor costs but continues to be a factor throughout the life of the installation from the standpoint of maintenance costs. The saving in erection cost is magnified because this cost increases out of proportion to the height. Architectural design is facilitated through the need for a lesser stack effect eliminating in many cases the necessity of breaking the modern lines of a building with an unsightly smoke stack. Some local ordinances restrict external stack heights and especially in the vicinity of airports the use of external stacks is prohibited.

A consideration of the application of forced draft also necessarily involves a comparison of the salient features of forced draft and natural draft burners. The criterion of a good burner is its ability to combine gas and air in the correct proportions for all settings and provide a fire which possesses certain characteristics. These are a high turndown ratio, a high flame-retention quality, a steady flame, and a flame with a high radiant heat emissivity. Automatic ignition and full flame protection may be incorporated.

When one of the package type forced draft burners with fully automatic controls is installed, installation expenses and the continued human element in fire adjustment are minimized. These economic factors are not always readily appreciated. All safety controls on a package unit can be adapted to a specific job and tested prior to shipment, per-

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mitting a more rigid control of the safety factor as compared to that obtained in a job-site installation.

The air-gas mixing characteristic of a correctly designed forced draft burner is comparatively constant over a wide range of flows, which is not the case for natural draft burners. The consistently more intimate mixture obtained with a forced draft burner permits operation with lower excess air, which in turn minimizes the draft loss from flow by virtue of the lesser volume of gases to be handled. This in itself represents to a somewhat indefinite degree a further reduction in stack height.

Like Carburetor

A good burner is much like a carburetor in that it proportions air in the correct amounts for good combustion to modulating gas flows. Refer back to *Fig. 1* and *2*, and for the sake of this example assume equal burner frontal inputs, the pressure drop from the areas. It is then seen that, for identical inputs, the pressure drop from the burner air chamber to the firebox must be identical for both burners. Also assume that both burners have modulating air louvres or registers in accordance with the best practice. Thus, on this basis alone, an atmospheric change (where no automatic stack damper is employed) will be reflected to a lesser degree in the firebox for the forced draft burner by virtue of the lesser difference between its associated furnace pressures and atmospheric.

Therefore the air flow through the forced draft burner is less subject to uncontrolled variation than that of the natural draft burner. Furthermore, to facilitate the introduction of adequate air at necessarily low pressure differentials, natural draft burners are commonly designed with greater frontal burner area for equal ratings. This still further amplifies the uncontrolled variation in air supply through the natural draft burner for atmospheric variations in comparison to the forced draft burner.

Uncontrolled air variations may lead to incomplete combustion on the short side or too high an excess air on the long side, either with representative heat loss. The liberation of carbon monoxide and free carbon to the atmosphere represents an initial heat loss deducted from the net heat of combustion of the fuel. On the other hand the excess air absorbs from the fire an amount of heat proportional to its exit temperature and wastes it to the atmosphere. In fact, high excess air creates a loading effect increasing draft loss in the boiler and impairing the ability of the stack to produce draft.

Although they may not necessarily show it from an examination of their exteriors, most boiler settings are loose and therefore subject to leakage. It will be found that air leakage into a setting tends to be greater in the case of a boiler operating under natural draft alone because the pressure differential across the setting wall is greater.

Resistance to air flow through a forced draft burner need not be of considerable magnitude. In the event of power failure, a correctly designed open port type, forced draft gas burner should be able to operate satisfactorily on natural draft alone with at least 60% of its rated capacity where the stack was designed with no oversize factor in conjunction with the use of a forced draft burner. Where the stack had been originally designed for a natural draft burner or with an oversize factor, it will operate at a somewhat higher capacity. However, a multiple venturi tube type, forced draft burner by reason of its greater resistance to air flow will not perform as well as the open port type on natural draft alone.

The noise level of a correctly designed open port type, forced draft gas burner is lower than that of an inspirating atmospheric burner of equal capacity. However, if fan bladings and housings are not correctly designed, they can be a distinct source of noise.

The positive air pressure behind the head of a forced draft burner eliminates popping or backfire when it is turned down. It also provides a positive means of ventilating a cold boiler before firing up.

The necessity of designing natural draft burners with greater frontal burner area proves a handicap where an installation must be made in a boiler base with restricted dimensions. Here a forced draft burner of equal capacity can be installed with ease because it has a greater heat release per unit frontal burner area requiring, therefore, a smaller entrance opening. In fact, the forced draft burner can fire very satisfactorily into a furnace volume which may be too small for efficient operation of a natural draft gas burner, eliminating the necessity of either raising the boiler or lowering its hearth.

Forced Draft Assets

The increased combustion rate of the forced draft burner is one of its greatest assets. It permits designing high heat load equipment to a minimum of material and space. Where it is desired to increase steam output from an existing natural draft installation, the necessity for buying more boiler can frequently be avoided by installing a forced draft burner.

A summarization of some of the more outstanding advantages of forced draft over natural draft alone is given:

More intimate gas-air mixture over a wider range.
Higher combustion rate.
Lessened susceptibility to draft changes.
Better air control.
Less stack effect necessary.
More compact burner frontal area.
Package unit.
Higher safety factor.
Minimized need for attention.

In conclusion, it can be seen from a consideration of this material that the development of the forced draft gas burner provides a much needed tool of considerable versatility in the field of heat engineering. This is evidenced by the fact that leading manufacturers of gas and oil burners are advocating the use of forced draft equipment.

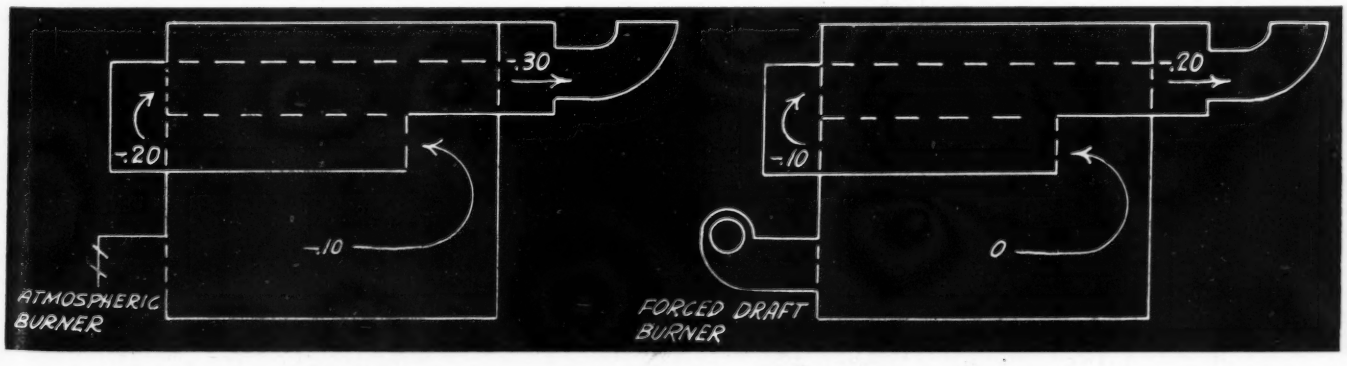
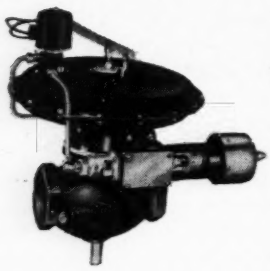
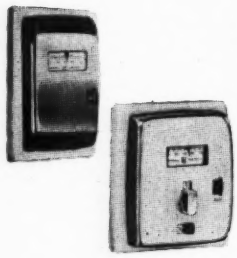


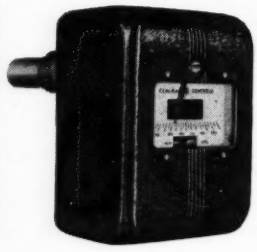
Fig. 1. Fig. 2.



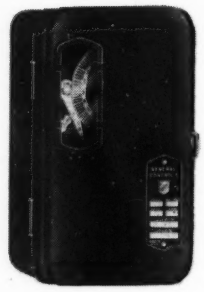
B-55 G Governor Type Valve



T-70 and T-70T Thermostats



L-32 Immersion Thermostat



5B Interval, On-Off Time Switch

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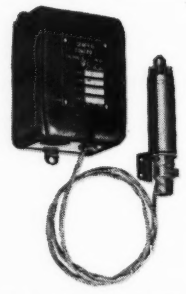
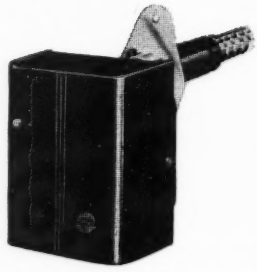
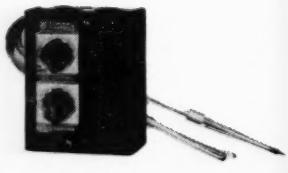
"for the best in automatic control, it's General Controls."



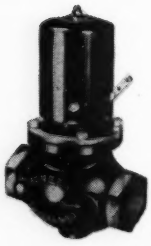
A-100 Thermopilot Relay



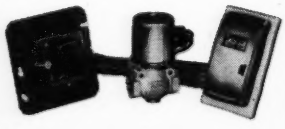
R-99 Stack Switch



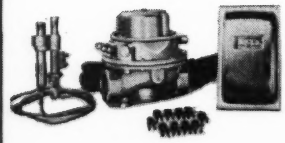
L-54 Solid Charge Combination Fan and Limit Control



Hydramotor G 1-7



T-30 Package Set



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CONVERSIONS:

How They Affect Work On Customers' Premises

By R. H. BUSSARD

BRIEFLY, for a period of time, a conversion increases the work and headaches of a department which performs work on consumers' premises. Some of the reasons for this and a few suggested remedies are herein discussed, based mainly on the experience in Washington, D. C., when in 1947 the gas distributed was changed from a 600-Btu mixed gas to straight natural of approximately 1100 Btu. The conversion of appliances was contracted. It was a one-step conversion by sections, averaging 1200 customers per section.

It should be realized that a very important man in the conversion picture is your customer contact employee. If he is not given proper understanding of the problem before the job begins, in many cases he can very easily create customer reluctance to accept the "new" gas, and he may cause unnecessary service requests and special investigations. You may ask, how does this happen? As long as you have humans performing your work you are vulnerable to this condition. Let me explain how this may occur.

The average person has the desire to show his "superior" knowledge. Even during normal operations the matter of one employee criticizing the work of a fellow employee is an everlasting problem. When faced with a conversion performed by personnel other than company employees, the temptation to this inherent weakness is great, and with despair you hear the customer say, "Your serviceman told me those young boys, still wet behind the ears, didn't know what they were doing when they converted my appliances. Now my bill has increased, the water heater is leaking, the maid has headaches, etc."

When streaming of top burners was noticed in Washington the company personnel studying this problem unfortunately began referring to these ranges as "sub-standard" stoves and used the expression of "insulating" to mean sealing and stripping to divert oven products of combustion from top burners. In a short period of time these expressions spread to the customer contact men and it was not long before customers were being told by some servicemen, when such a range was encountered, "I am not equipped to correct this for you, madam, as this is a 'sub-standard' range and it will have to be 'insulated'." This could have been a customer who bought from the company a high priced fully insulated range. Would you like to be on the company end of the telephone call resulting from this serviceman's statement? If she did not buy from the company it is even worse, for then she calls the builder, real estate agent, or apartment house manager because she has an inferior product and she knows it is inferior because the gas company man told her so. What happens here? The builder or agent calls the company, swears he will never use gas again, threatens suit because of libelous expressions and demands the company replace the range with a type designed for natural gas.

There are those calls where the customer contacts the company dissatisfied with appliance operation and knowing her appliance will never operate to her satisfaction for the serviceman told her "natural gas will never work as well as the manufactured gas."

I have cited these instances to point out the value of action before conversion. Your personnel must be trained in recognizing satisfactory natural gas flame characteristics. Sell your customer contact employees on the benefits of conversion. If they know it will result in a brighter future for them, then they will help to sell the dissatisfied customer rather than heap coal on the fire. Educate them in the problems relating to conversion. If you decide to utilize the services of a contractor to perform your conversion, point out the advantages of this method, the magnitude of the project and the problems of the contractor. If this is done properly your men will be proud of the job being performed, be less anxious to be critical, and be tactful in their contacts. This is an extremely important item and should not be overlooked in the maze of problems that arises when preparing for a changeover.

Then there is the job of training your mechanics in the techniques of converting appliances. This is a "must" even though a contractor does the original convert work. You will have the "clean-up" job and will always have appliances added to your lines which require conversion. It is beyond the scope of this paper to outline the methods and details of converting an appliance but I do want to point out some of the most difficult and baffling problems you are likely to encounter.

Largest Difficulty

The largest single difficulty may be in converting the most common of all appliances and the one which at one time was least suspected to give trouble—the range. In certain types of ranges, when natural gas is used and the oven is in operation, the products of combustion from the oven leak into the top burner compartment causing poor ignition and lifting of flames from the top burner ports, giving what is known as a "streamer" — don't call this range a "sub-standard" stove! To correct this condition frequently involves caulking, use of special designed flue outlet fittings and metal strips, or remodeling. Naturally you will be faced with customer resistance when you change the complexion of her favorite appliance. It is highly recommended that if it is at all possible, the performance of different

Mr. Bussard, superintendent of service, Washington (D.C.) Gas Light Co., originally presented this paper at the 1950 AGA motor vehicle and corrosion conference, Detroit.

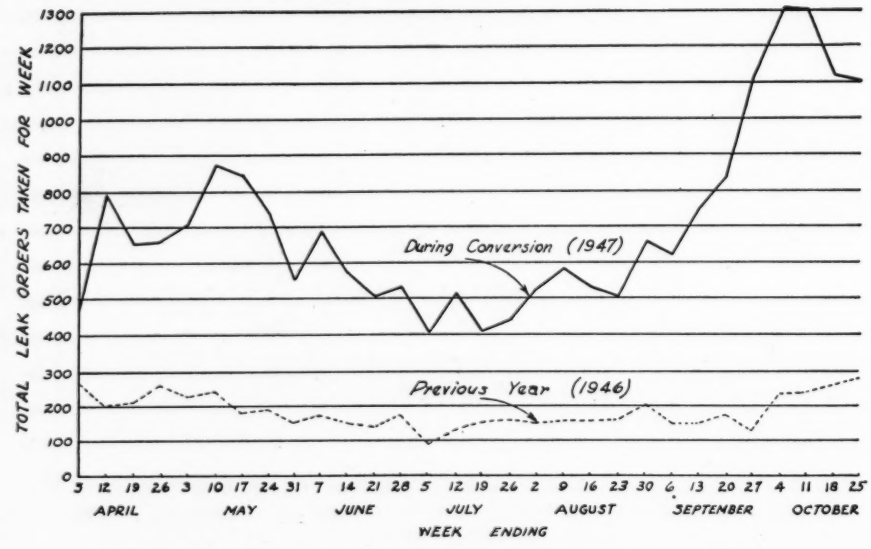

Chart II. Leak orders taken during conversion compared to previous year.

makes of ranges be studied before the conversion starts, design your correction methods, educate your men in recognizing "streamers" and train and equip a special group of men to handle the volume expected.

Special Problems

Because of the slower burning or less stable natural gas flame as compared to a gas containing an appreciable amount of hydrogen, you may expect to encounter difficulties in converting oil burner pilots and burner flames that are subject to disturbances in the air surrounding the flame, such as railroad track switch heaters and burners used for spot heating in manufacturing tin cans. The sudden agitating of the atmosphere in the combustion chamber of an oil burner, the "swish" of railroad trains over the switch heater or the speed of tin cans passing the burner, may create a disturbance sufficient to extinguish flame. The oil burner pilot is one that may cause many headaches, not only from a service angle but from high bill complaints, if the problem is not studied and sufficient men are not well skilled in its conversion.

It is recommended the conversion of special burners on your system be investigated. In this category you will find dental torches, laboratory burners, art metal or hobby burners and burners used in glass factories. It was even difficult to find lab burners designed for natural gas operation that would give satisfactory service. This condition was investigated by the National Bureau of Standards and for details I refer you to "A Study of Laboratory Bunsen Burners for Natural Gas" by John H. Eiseman, NBS42, 541 (1949) RP 1991.

If you serve an appreciable number of commercial customers you probably will find it difficult in many instances to provide full rating or previous input on certain commercial appliances, more notably steam boilers, and broilers equipped with ceramics. This is due mainly to the fact that natural gas has a lower flame propagation rate and for its combustion, a relatively larger combustion space is required. The almost universal practice of over-gassing of these appliances, which was possible when using manufactured gas, makes the problem more acute. Lowering the burners on steam boilers and coffee urns is an example of how a satisfactory conversion may be accomplished.

On radiant fire heaters and gas logs it is difficult to obtain good natural gas performance after conversion because of minor dirt or dust obstructions and the customers' desire to have these appliances over-gassed as had been the case when using the manufactured or mixed gas. In connection with the conversion of these appliances you should be prepared to replace many radiants and ceramics because they are easily broken after they have been in use for a few years.

Let us suppose you have mastered the techniques of how to convert and the job starts. What problems follow?

You may expect to experience an immediate increase in service requests from customers in converted areas. As conversion progresses, the men performing the conversion become more skilled, procedures are improved and the efficiency of the conversion improves, thus service requests per unit of customers reduce.

Work Increases

I know every service department supervisor when approaching a conversion job wants to know how much the work load will increase and how long will it last. I am sure there is no one who can give you the answer. Many factors are involved and each conversion will most certainly have its own service load characteristics, depending on saturation of different makes and types of appliances, efficiency of the men performing the conversion, the season of the year when the conversion is performed, the condition of your distribution system, etc. If you would like to see a typical example of the immediate

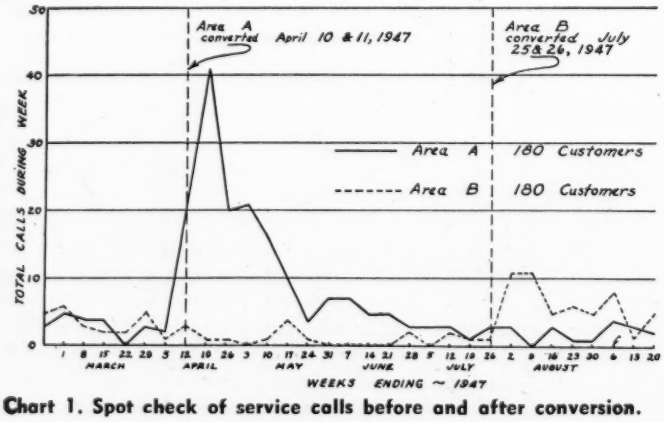

Chart 1. Spot check of service calls before and after conversion.

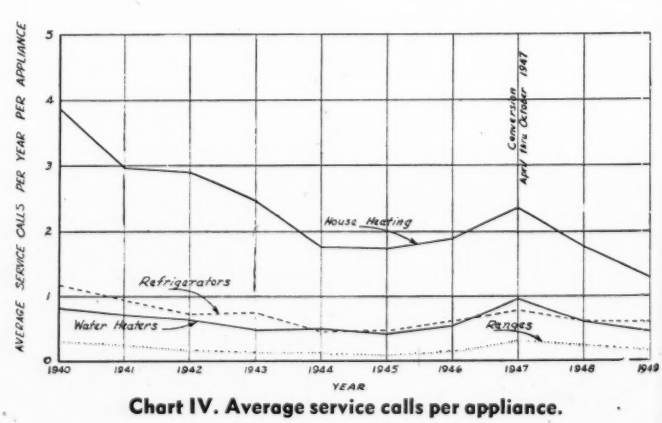

Chart IV. Average service calls per appliance.

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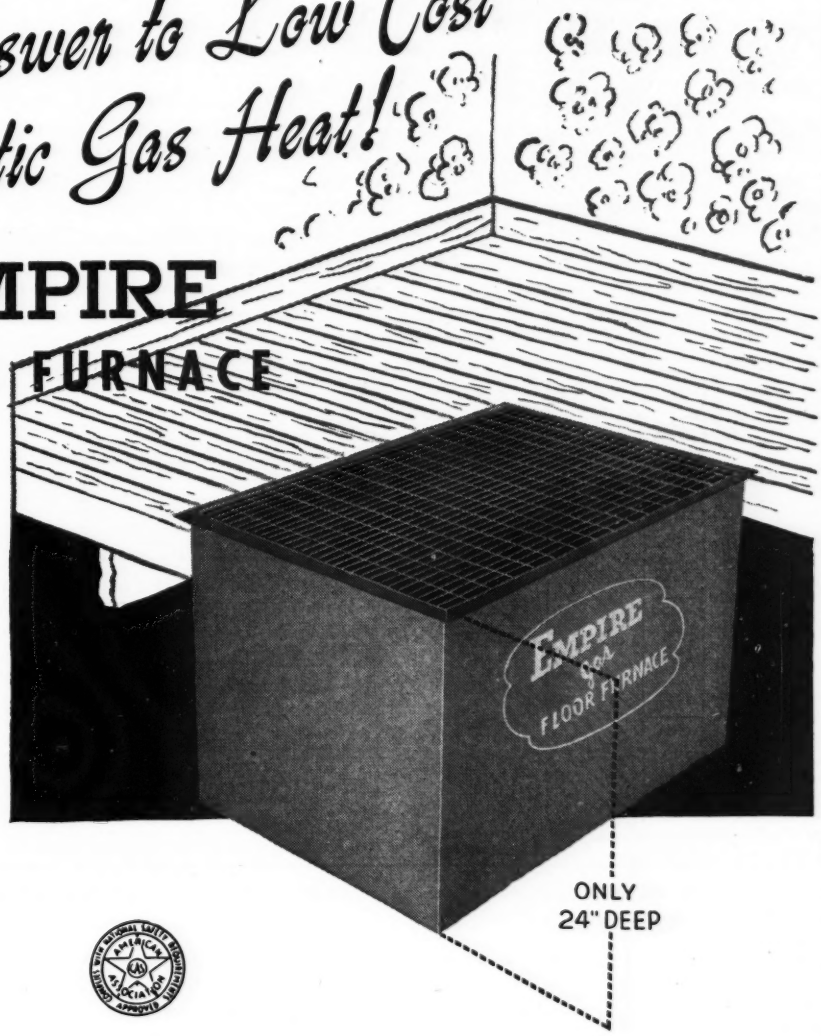

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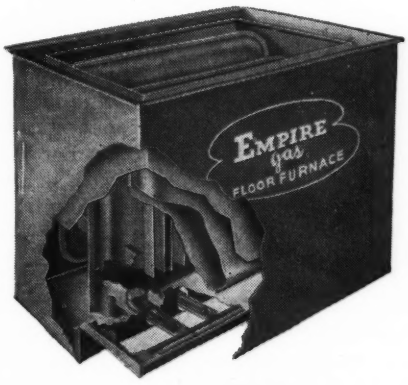

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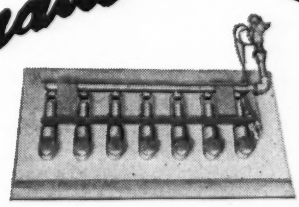

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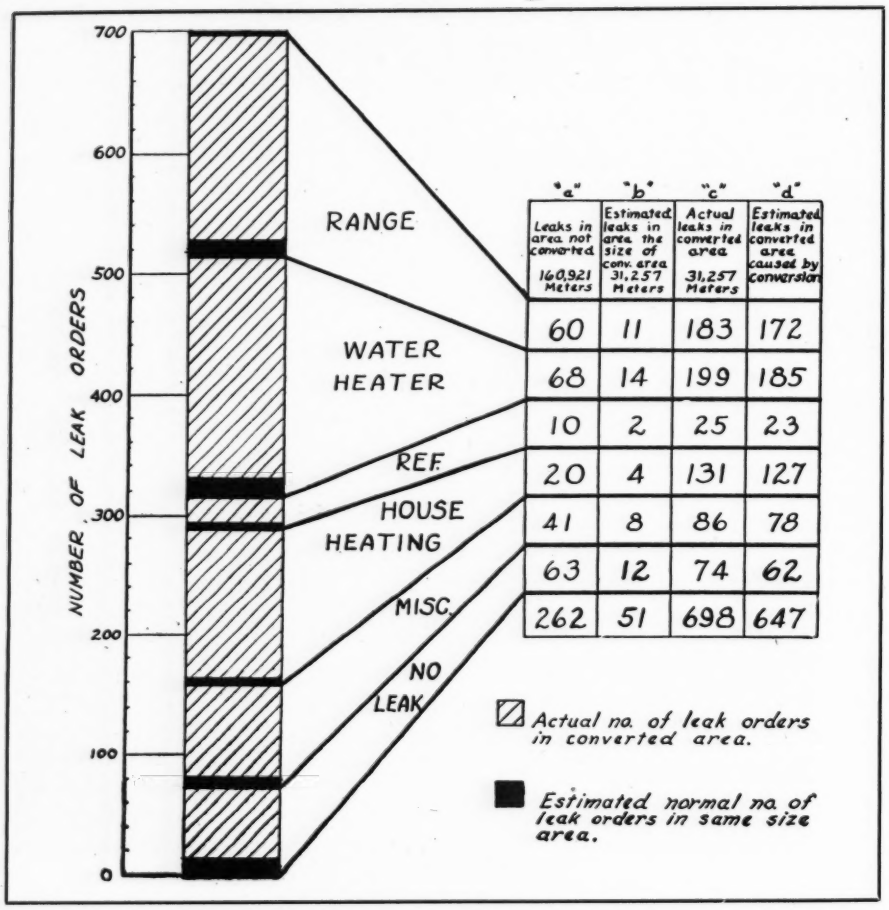


"a" Leaks in area not converted 160,921 Meters	"b" Estimated leaks in area the size of conv. area 31,257 Meters	"c" Actual leaks in converted area 31,257 Meters	"d" Estimated leaks in converted area caused by conversion
60	11	183	172
68	14	199	185
10	2	25	23
20	4	131	127
41	8	86	78
63	12	74	62
262	51	698	647

Chart III. Study of leak orders in converted area, May 6 through 16, 1947.

effect conversion had on service requests in Washington, I refer you to *Chart I.* Two areas were studied. In each of these areas 180 customers were selected for observation, representing a like number of appliances by types. Total service calls per week for these customers were plotted for seven weeks prior to the conversion of area A, which indicates they were comparable customers. Area A was converted April 10 and 11, 1947. (Conversion started April 1, 1947.) Area B was converted July 25 and 26, 1947. You will note the peak in area A is considerably higher than that of Area B. This was probably due to two factors: (a) the conversion efficiency at the time of Area A conversion was relatively lower than when Area B was converted because the conversion was only a few days old when Area A was converted; and (b) the effect of poor conversions of househeating equipment in Area A was immediately felt since house heating equipment was still in use, whereas in July, when Area B was converted, this was not true. The chart gives an indication, and I emphasize because of the many variables, it is only an indication, how long the immediate impact of a conversion is felt in any particular area. You will also note I say immediate impact. You, who may have a conversion performed in the summer and also have an appreciable saturation of house heating, will not experience the full force of service requests of the conversion job itself until you advance into your heating season.

Leak Complaints

One of the most annoying types of service order, at any time, is the leak complaint. I mention this because you can expect an appreciable increase in this type of order. *Chart II* shows the number of leak complaints received by our Telephone Service Bureau, by weeks, during our conversion period compared to same period in 1946. A spot check was made in May 1947 when 16% of the total meters had been converted. At that time leak complaints per thousand meters in the converted areas averaged 22.3, and 1.6 for those meters in the unconverted area. A study of the leak orders for this spot check is shown on *Chart III.* At this time we recorded 698 leak orders for the 31,257 meters converted and 262 orders for the 160,921 meters not converted. An attempt was made to estimate the number of leaks that were the direct result of conversion by first recording in column "a" the leaks received in the unconverted area (160,921 meters); in column "b" estimating the leaks that would have been received from an area the size of the converted area (31,257 meters) based on the experience in the unconverted area (leaks in "a" multiplied by 31,257 ÷ 160,921); and subtracting this from the actual number of leaks received from the converted area (column "c"). The result is shown in column "d." By analyzing column "d" we came to the conclusion that, although the majority of the leak complaints may have been caused by the mechanical conversion of the appliances, most certainly an appreciable number were not. It was therefore reasoned that many minor leaks existed prior to conversion, but because of the difference in odor of the two gases and the publicity given the conversion job, plus the fact that someone had overhauled their equipment, the customer became more critical of appliance operation and more safety conscious, thus requested service that normally would not have been requested. Although the conversion was completed in October 1947 the leak calls did not return to normal until about the middle of December of that year. The peak shown in October 1947 was caused by the accumulated effect of leaks from newly converted areas plus leaks at house heating equipment converted during the summer which were not detectable until the equipment was started.

Coffee Ready?

We do know that converting range burners to rated input, which in many cases was either smaller or greater than prior input, resulted in numerous complaints. I remember one customer who was positive the "new" gas was not hot enough because with the "old" gas he could arise, turn on the range burner under the coffe pot, and after shaving have a pot of coffee ready to drink. After conversion his coffee was not ready when he finished shaving. With the burner converted to rating it is obvious it had previously been over-gassed—but that is the way the customer wanted it and of course was not satisfied until the orifice was enlarged to duplicate previous input.

We do know that it is almost wasted effort to attempt to convert hotel and restaurant top range burners to rating. You could never get away with this prior to conversion so be prepared to over-gas them at time of conversion. The chef is still the king to whom we bow.

With the completion of the changeover in October 1947 I am sorry to say we did not complete our troubles. Almost simultaneously with our peak load of house heater starts and service requests caused by a sudden cold snap, we experienced a great increase in pilot outages, particularly on ranges and water heaters. The peak was during the week ending Sept. 27, 1947, when the Tele-

phone Service Bureau received approximately 17,000 service requests as compared to 2000 for the same week the year before. Six thousand of this increase was for furnace starts.

Gum Trouble

At first the pilot difficulty was confined to a relatively small area but later spread over a larger territory. By pinpointing the location of pilot outages and photographing the map daily we were able to see how the trouble progressed. We had not anticipated gum trouble for we had never before heard of a manufactured gas company converting to natural gas and then finding itself right in the midst of gum problem, so when trouble first appeared we thought the "dust storm" had arrived.

Our investigation showed fresh gum was being deposited in the pilots. This lasted for several months and then subsided. In the meantime gum filters were installed in pilot lines as rapidly as possible. Talking to the personnel in the New York & Richmond Gas Co., which company recently completed a conversion, I found they experienced gum trouble and recommended consideration be given to the installation of gum filters at time of conversion, for it was a major problem with them as well. If you ask me why this happened in Washington I refer you to our chemists. A possible explanation may be the fact that early in 1947, just before changeover, we had occasion to use a substantial quantity of carburetted water gas and it was entirely probable that quite a bit of vapor phase gum was laid in the system then. When the fall season came along this gum started to decompose and was carried in the gas stream. The NO was liberated from the decomposed gum and joined with other constituents to make fresh vapor phase gum.

Clearing Stoppages

In November 1947 we received about 26,000 service calls for water heaters and ranges. We discovered that approximately 60% of those calls were confined to a particular area. Normally we would expect about 7000 calls.

It may be well to add here that the New York & Richmond Co. experienced service, meter, and house piping stoppages due to napthalene after they changed over. They cleared stoppages by flushing with gas oil and now this trouble has subsided as the naphthalene has evaporated or has been flushed.

So much for some of the headaches during and immediately after conversion. What are some of the problems that may follow this period?

Our company redesigned the production equipment to produce a high-Btu oil gas to act as a substitute for natural. In January of 1948 the supply of natural gas was curtailed due to a line break and because of the load demand due to cold weather, it became necessary to manufacture gas. When the manufactured gas was distributed, even though mixed with natural, the change in the odor was so great we received an all time high of 2500 leak orders in one week, 1500 of which were received in two days. During this period of manufacturing, pilot calls increased appreciably due to the distribution of gum in the "make" gas. This is one of the reasons we recommend consideration of the installation of gum filters on all pilots.

Manufacturing and mixing a high-Btu oil gas and natural gas also presents another service problem, for if a certain percentage of manufactured to the total is exceeded, you may expect trouble due to the utilization of a gas having a higher rate of flame propagation in burners with port areas relatively large, designed to satisfactorily burn natural gas. When adjusting burners during the time high-Btu oil-natural gas mixture is being used, it is highly important to instruct your service personnel regarding the hardness or softness of flame, so satisfactory adjustment results without a call-back when you return to normal operations.

Compensations

Since conversion a careful watch has been kept on pilot outages to detect sections of the system which may be drying to the extent that the gas stream carries suspensoids by the use of a portable Tyndall Beam apparatus and other means. Pilot filter installations were made at time of service calls and as soon as practical, the area was wet down by gravity method, with a compound sold commercially for stopping leaks at main joints. After treatment with this material the Tyndall Beam checks showed immediate allaying of suspenoids and trouble cleared. During 1948 and the early part of 1949 the older and most troublesome areas were treated and now we experience no localized difficulty of this nature.

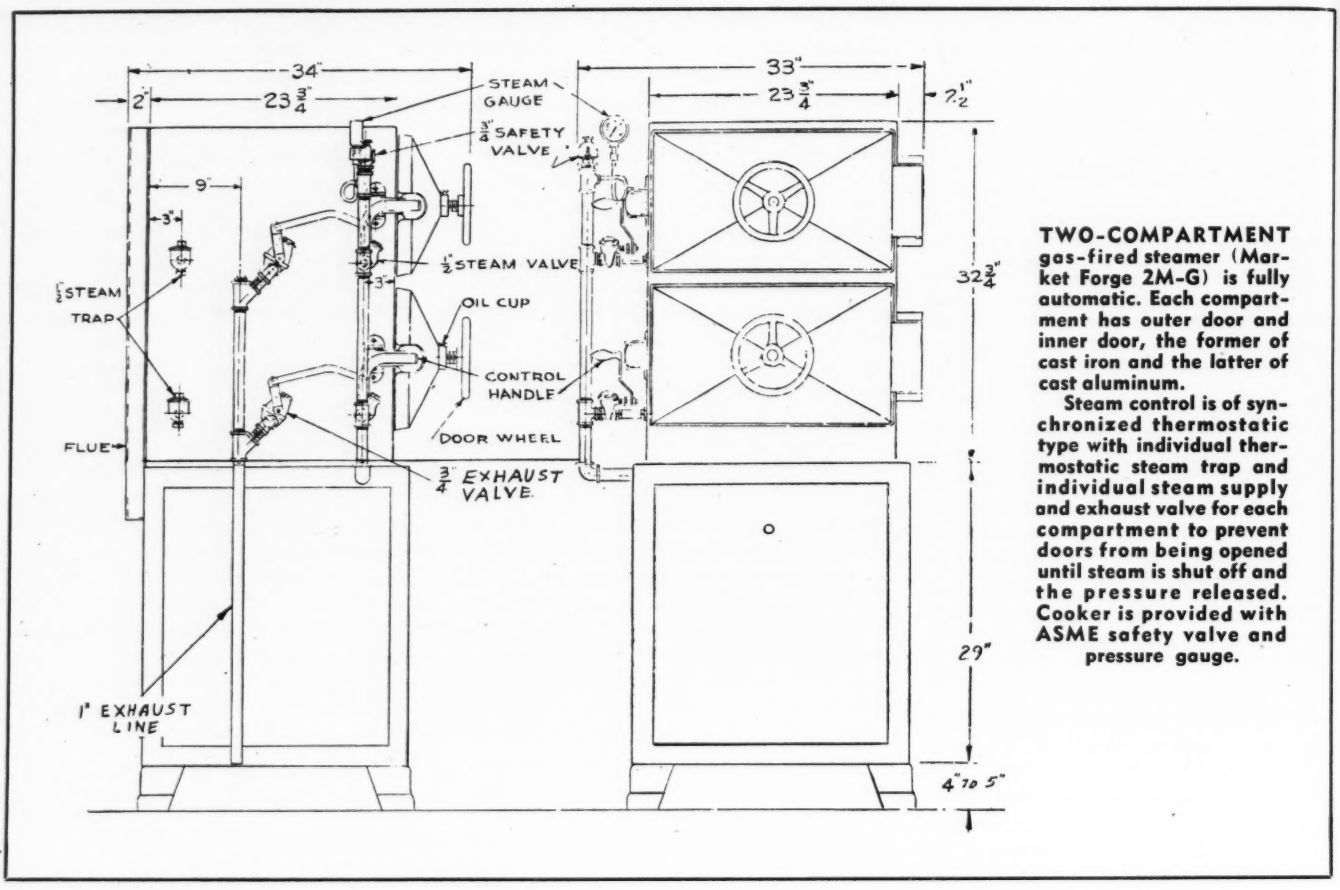
With all these headaches, you may ask, "Isn't there anything worthwhile in a conversion as far as work on consumers' premises is concerned?" There most certainly is and I refer to *Chart IV*. Here you see orders per appliance for the four major appliances, plotted by years since 1940. The years 1940 and 1941 may be assumed to be normal years for we, like yourselves, experienced a decrease in orders per appliance during the war. So, when comparing the years after conversion, we should go back to 1940 and 1941 for base.

Water heaters and ranges probably present the most comparable appliances for there was no major change in service policy regarding these two appliances since 1940. The more favorable position of refrigerators now as compared to 1940 and 1941 reflects to a minor degree a change in policy wherein we have discontinued voluntarily cleaning refrigerators on a schedule which we were doing in 1940 and 1941. Excluding the voluntary service, the calls per year per refrigerator were 1.00 and 0.80 in 1940 and 1941, respectively.

House Heater Changes

The appliance showing the most favorable change as you notice, is the house heater. There are two factors, unrelated to use of natural gas, which have influenced this trend, namely (1) a more intensive campaign to have customers leave their househeating equipment pilots on during the summer, or, learn to start and turn-off without requesting company service, and (2) the degree days in 1948 and 1949 were 4124 and 3448 as compared to 4726 and 4087 in 1940 and 1941, respectively. To enumerate the effect of each I am afraid will require too much detailed discussion but I do want to point out that by the use of natural gas a very appreciable saving has been realized in eliminating practically all voluntary inspections and cleans of househeating equipment. Prior to the use of natural gas we had all of our househeating installations on a periodic clean schedule, varying from yearly to once every four years, depending on the make and type of appliance. To date we have not found it justifiable to make periodic inspections or cleans of househeating equipment with the one exception which we are studying, and that is the conversion burner. Even though natural gas is used, when a furnace is converted from oil or coal, an appreciable amount of scale is found after the first year which, according to the chemists, may be due to the sulphur which has been absorbed in the equipment sections and continues to exert its corrosive effect until it is spent. At this particular time we are not certain whether a good cleaning after the equipment has been in use one year is sufficient, but we do believe that a thorough cleaning after the first year is justifiable.

This discussion is not intended to leave with you the impression that nothing "goes well" during a conversion. Realizing that any natural gas changeover is a tremendous undertaking, regardless of how it is done or who does it, and despite my elaboration of some of the problems, we in Washington were extremely pleased with the minimum customer disturbance experienced and we feel the same general plan would be followed if we had it to do again.



TWO-COMPARTMENT gas-fired steamer (Market Forge 2M-G) is fully automatic. Each compartment has outer door and inner door, the former of cast iron and the latter of cast aluminum.

Steam control is of synchronized thermostatic type with individual thermostatic steam trap and individual steam supply and exhaust valve for each compartment to prevent doors from being opened until steam is shut off and the pressure released. Cooker is provided with ASME safety valve and pressure gauge.

STEAM COOKING

There's a wide-open market for selling this method of commercial cooking, and its many advantages are helping supply a new gas load.

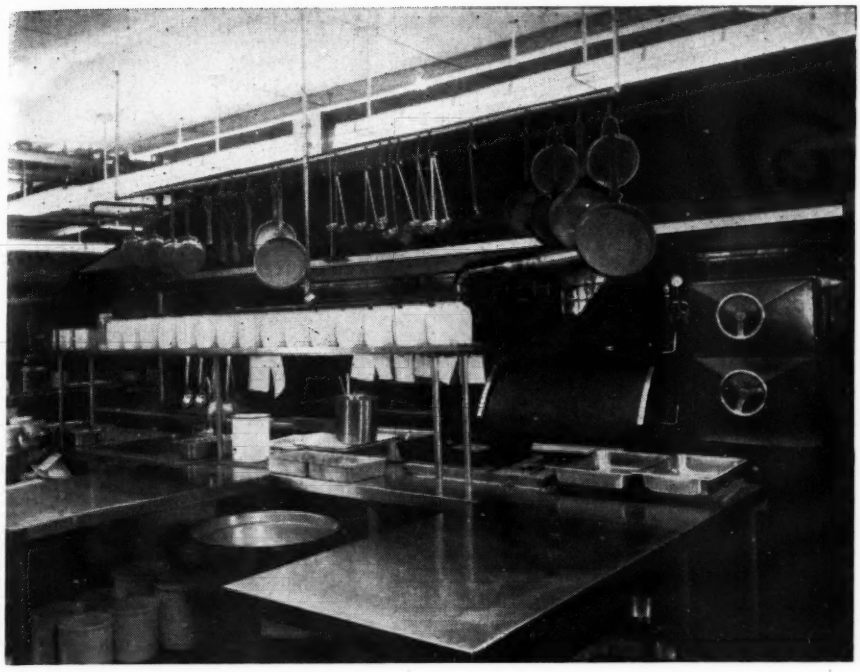
By J. HARRISON HOLMAN

STEAM cooking, as we know it, is cooking with live steam—the live steam coming in contact with the food. The food is placed in an enclosed appliance called a steam cooker or pressure cooker. These steam cookers operate at pressures from atmospheric to 15 lbs. The free venting steam cookers (operating at atmospheric pressure) provide the temperature of boiling water (212°) in the cooking compartments while thermostatic or pressure steam cookers employ temperatures up to 250°F.

In steaming, there is constant delivery of heat units to the food without any circulation or temperature change. And that is why the steaming process causes the food to retain more valuable nutrients and why the process proceeds at a fast rate. There is no dilution of foods to any extent and no drying out. As the food heats up and approaches the temperature of the steam, the condensation rate gradually decreases. Thus no more steam is condensed than is required to bring the food up to the temperature of the steam and to hold it there during the cooking period. The vitamins and minerals in the food are therefore exposed to the dissolving effects of a minimum quantity of water.

The importance of cooking with live steam can be brought out by the fact that steam at 212° has a great many Btu's of heat in it that boiling water at 212° does not have. It takes approximately 970 Btu's to make 1 lb of steam from 1 lb of water at 212°. When this steam comes in contact with the food, the same number of Btu's must be given to the food in order for the steam to condense to water, so, looking at it from this point, we can see that when cooking with live steam it is possible to have a great deal of heat without having a very high temperature. To bring this out more clearly, consider a 25 lb turkey. If this turkey is placed in an oven it will take from 3 to 4 hours at 350° to cook it whereas, if the same turkey is put into the steam cooker, it can be cooked in 1½ to 2 hours, at 220°F.

Mr. Holman is a member of the Food Service Division, Market Forge Co., Everett, Mass.



GAS-OPERATED steam cooker at the Worcester (Mass.) Club is a Market Forge model 2M-G. Operators find it increases food value, reduces shrinkage, provides a constant heat without variation or circulation.

We all know that it cuts down shrinkage to cook at lower temperature, and in this case we have been able to cook at a very low temperature and at the same time do the cooking very fast.

Retaining Food Value

The interest in steam cooking today is not entirely due to the fact that the food service operator saves money, but is also due to increasing public interest in food values. The man on the street is anxious to know that his food contains all its original value. During the war, there were extensive tests in cooking made at the Pentagon building in Washington. The results of these tests have been made available and they show definitely that steam cooking is the best method of cooking food to retain its natural goodness. Steam cooking of foods is not new and is not in its experimental stage.

Housewives for years have been practicing this method of cooking by using the double boiler with a perforated top pan, which is similar to the modern commercial steam cooker in that the steam, and only the steam, comes in contact with the food. The present day use of the household pressure cooker for use in small quantity cooking has also added its bit to increase the popularity of this method.

There are many advantages to cooking with steam. Steam cooking equipment does not take much space. A two-compartment steam cooker takes a floor space of approximately 9 sq ft. This cooker, because it is one tier on another, will do the work of a 5- or 6-ft range top, and at the same time, because we are cooking with live steam, will do that job in about one-half the time.

In addition to these two savings, the savings in fuel are remarkable. One pound of steam will cook between 3 and 5 lbs of food; it would take approximately 2 cu ft of natural gas to produce 1 lb of steam. The 1 lb of steam has, therefore, cost the operator about 1/10th of a cent for 3 lbs—the exact amount depending upon gas rates.

By the use of this method of cooking, very little fuel is wasted, because when a steam cooker is not being used it has to be turned off. The steam has to be shut off before the food is taken out of the compartment. With the gas-fired steam cooker, the flame is automatically shut down when the gas-fired boiler reaches its required pressure.

Pre-Cooking Meats

In addition to cooking vegetables, the steam cooker can be used for pre-cooking meats, for cooking fish, clams, lobster, and shrimp. It is also being used to cook poultry. One of the food service operators in Providence, R.I., is using a steam cooker to cook all his chickens. As a matter of fact, he cooks about 90 chickens every 35 minutes. In this case, he is able to save the chicken stock which comes from each compartment, so that there is no waste connected with the operation. He is also using the steam cooker for blanching french-fried potatoes, which means big savings in fat. Steam cookers have been used to prepare soups, cereals, and puddings. Steam cooking eliminates scorched pans and burned food. It is impossible to burn food in a steam cooker, and by the same token it is impossible to scorch pans.

Big Sales Potential

Food is easily removed from the baskets, eliminating the handling of heavy pots filled with boiling water.

The possibilities of steam cooking are tremendous. A recent survey showed us that only 10% of the food service operators that could be using steam cooking are doing so. Any restaurant that has over 50 seats or is serving more than 150 people a day can use a steam cooker. The appliance is easy to operate, its temperature is automatically controlled, and above all it is safe to operate.

The modern steam cooker is equipped with valves to release the pressure from the compartment before the door is opened, thereby eliminating the risk of the operator being burned by the steam coming out of the door.

When choosing a steam cooker for a certain installation, if there is a steam supply available on the premises, we would recommend the use of a direct-connected steam cooker. If there is not a steam supply on the premises, but there is a possibility of the food service operator using steam for coffee urns, steam tables, dish washing machines and also a steam cooker, we recommend that they buy a gas-fired steam generating plant to handle the appliance.

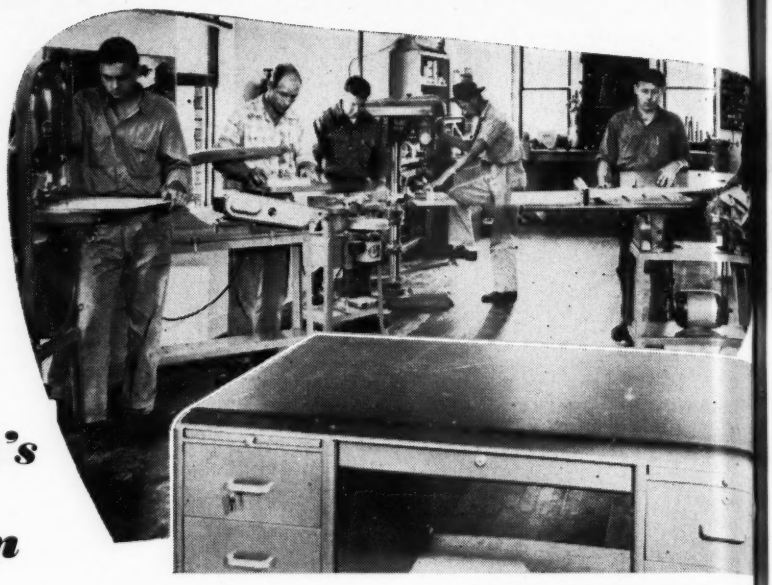
Assuring the Load

If the establishment does not warrant the installation of the steam generating plant, then we, of course, recommend a gas-fired steam cooker. The gas-fired steam cooker is as a rule made in a two-compartment size. It is equipped with a 2-hp steam generator. This includes a water feeder, a pilot light, a safety valve and a steam gauge.

I think that if commercial gas salesmen can show the food service operator how to save money and do his cooking and still use gas (perhaps less gas than he used before), the gas loads from that customer will be assured.

By getting a food service operator to install a steam cooker, you may not necessarily increase his gas load but you will be doing him a service, and by the same token you will be doing yourself a service, because one satisfied customer will lead to another.

Fulltime Squad Streamlines Company's Maintenance Program



WORK HEADQUARTERS are these facilities in Bridgeport, Ohio. Crew works out of this office to handle Pittsburgh Group maintenance tasks.

Wayne Parker and his seven-man crew of trades experts have yielded returns for the Pittsburgh Group companies on the investment in tools, time, and training for an office maintenance program.

CONFUSION and waste can often be the result when "local option" is in force as the ruling agent in the maintenance programs of local offices within a gas distribution department. Buying meters, securing work permits, and laying new services soon become all-important, and the housecleaning and repair jobs that are so important from morale and public relations standpoints are neglected or ignored.

Before a planned, coordinated program was underway, the 74 local business offices of the Pittsburgh Group companies, scattered over Pennsylvania, New York, Ohio, Maryland, and West Virginia, had varieties of paint shades in offices totalling about 25—and modernity, cleanliness, and even visibility within the offices varied widely from manager to manager.

This divergence of decorative and refurbishing opinion came to an end when the company organized the maintenance and redecoration chores under a single agency, and the building maintenance program that the company has in force today does an excellent job. For this, most credit is due Wayne Parker, a 14-year Pittsburgh Group veteran who took over supervision of the department in 1943.

Trade Specialists

Mr. Parker maintains headquarters in Bridgeport, Ohio, for his seven-man crew—each member of which is a building trades expert. This team handles all repair and maintenance activities of the distribution department office, meter shops, and warehouses. Mr. Parker's annual schedule takes him into each busines office, warehouse, and shop, where he notes all needed repairs and renovations.

Before leases are signed for new office space, he inspects the property, records all the jobs that need to be done, clears with local authorities on the use of his "floating crew" and makes arrangements to hire needed licensed plumbers, electricians, and other craftsmen when the job is underway.

Operation Face-Lift

Pittsburgh Group standards for office furnishing, decoration, and layout are high. Currently the maintenance crew is replacing wood and linoleum floors with asphalt tile or rubber tile, old lighting fixtures with modern, efficient ones (old fixtures from offices are taken to the Bridgeport repair shop, restored to workability, and used in shops or warehouses). Paint schemes have been developed in cooperation with Pittsburgh Plate Glass Co., and every two years the Pittsburgh Group distribution offices get new coats—if the walls are painted green in 1950, they'll be a rose-tan in 1952. This alternation of colors gives the office a fresh, new look, boosts employee morale.

When new steel desks are purchased for an office, the old wooden veterans they replace are shipped to Bridgeport, there to be overhauled from top to bottom, refinished, and sent to shops or warehouses for further use. The same thing is done with electric fans and filing equipment. And if new filing cabinets don't match the color scheme of the office—then Mr. Parker and his crew will change the color scheme to fit.

Work Record

During the past two years, the crew has constructed and renovated eight distribution offices and minor face-lifting has been accomplished in others. Ultimately, all 74 of the distribution offices will have bill-paying desks built into counters, tile flooring, fluorescent lighting, spotlights-in-ceilings for display purposes.

The Bridgeport headquarters of Mr. Parker's crew is a two-story brick building that houses a shop equipped for all types of wood and metal fabrication. There is a 14-in. bandsaw, 23-in. scroll saw, 10-in. electric saw, 6-in. joiner, 12-in. turning lathe, 17-in. combination drill press and mortise machine, and a shaper with molding bits. This equipment allows the crew to design and build counters, cabinets and shelving, display pedestals, and other fixtures and furniture to transform a bare warehouse into a business office. Each man in the Parker team is versatile in the crafts, but some jobs get "special treatment" by crew members who excel in them. Three of the men handle most of the tile-laying; two more are expert in laying concrete blocks; one is a plumber, another is a trained cabinet-maker, still another is particularly good on painting jobs.

FINANCIAL

SHIPPERS KEPT HOPPING

Appliances move fast, competitors keep pace

That sales of gas appliances were still barreling along at a record pace at the end of July was evident as shipment figures piled up in the offices of GAMA statisticians last month.

Latest reports from manufacturers showed a healthy spurt in househeating and air conditioning equipment shipments as the industry's "Sell 'em Comfort" campaign began rolling. On the heels of a new high of 97,300 in June, manufacturers rolled out an estimated 111,600 in July, 121% ahead of the corresponding month in 1949, to bring the seven-month total to 526,000, 138.5% better than 1949's seven-month's total of 220,000.

Water heater gains, while not as spectacular, nonetheless bulked large. Sliding slightly from June's peak to 194,800, they still reflected in July the best gain of any month in the year—a solid 70.3% ahead of 1949. For the full seven months, they were 62% ahead, and at 1,232,700 were only 27,300 behind the total for the entire 12 months of 1949.

Range shipments scored thumping gains, July's 248,000 almost doubling the previous year's 125,800. Year-to-date sales were 1,592,600, about two-months' distance behind total (12-month) shipments in 1949.

The record in heating shipments tended to bear out predictions of a million-plus new installations for 1950, as orders for gas conversion burners alone reached 41,000, almost a high for the year, to bring the seven-months' total to 204,900—only 85,000 behind 1949's 12-months' orders.

Furnaces scored 63,000 for the month, a whopping 215% gain over July 1949, bringing the year's total to within 12,000 of the record for the entire year 1949.

Competitively, the picture was scrambled. Riding along on its "Court of Flame" promotion, the industry gained slightly on its electrical rivals, pushing the ratio from 1949's 1.9-to-1 (in favor of gas) to 2.2. But in ranges, the same old ratio of 1.5-to-1 prevailed, although it was beginning to slip. Through June, electrical shipments were 66.3% ahead of 1949, while gas shipments were but 60.1% ahead.

Gas, Electrical Service Growth Outstrips Population

The spread of gas and electrical service in the United States is outstripping the growth in population, a GAMA statistical survey just released reveals.

While census takers ferreted out 149,829,400 persons in 1950, a boost of 13.8% over the 1940 population, gas utilities were gaining customers at a rate of 33.5%, LP-Gas purveyors were clipping off a 543.8% gain, and electrical services were spreading at a 51.1% pace.

Combining the LP-Gas and utility gas gains for comparison with electric services, which embrace both city and rural areas, GAMA found that for all types of gas increases amounted to 57.1%, surpassing electrical installations by an even 6%.

Gas service now reaches 64% of the total occupied dwellings in the United States—27,083,000 now enjoy the super fuel out of a total of 42,100,000. In 1940, when LP-Gas dealers had only 800,000 customers, the ratio was slightly less than half—49%.

Electricity, meanwhile, is now in 37,179,700 homes, having moved from a percentage figure of 71% in 1940 to 88% today.

Alone, LP-Gas has scored gains from 1940's 2% to today's 12%.

Gas scored its greatest gains in the eight mountain states, where LP-Gas sales have skyrocketed. Percent change is 77.6%. Electricity made its best showing in the four east south central states—141.8%.

Utilities Big Spenders; Complete Record Quarter

If estimates of the Department of Commerce and the Securities & Exchange Commission are reasonably close, the gas and electric industries have just completed a quarter in which they spent more money for capital expenditures than in any quarter in history.

For the July-September period, utility statisticians told the government agencies that they estimated plant construction and equipment outlays at a total of $910 million —$120 million ahead of the similar period in 1949.

For the quarter just starting, a levelling off to $850 million is anticipated—$40 million less than last year, but sufficient to bring the year's total to $3,170,000,000, a gain of $30 million over 1949.

The third quarter's hefty effort overcame slightly lower comparative (with 1949) figures for the first two quarters.

Aside from the manufacturing industry, whose third-quarter gains also wiped out shortages for the first two quarters, utilities were the only elements of industry to record advances. This bore out first-of-the-year estimates, which indicated that utilities alone would increase expenditures.

It is felt that fourth-quarter estimates are conservative.

The sudden acceleration in activity coincides with the start of the war in Korea.

THIS IS "Manhattan House," New York Life Insurance Co.'s 20-story, 582-unit apartment building in New York City. Every unit contains a Roper gas range. A number of models from "rangettes" to 40-in. ranges with deluxe features were installed. The project was to be ready for occupancy Oct. 1.

West Virginia Firm Absorbed

More efficient and economical natural gas service to western Pennsylvania is expected to result from the sale of Natural Gas Co. of West Virginia to Manufacturers Light & Heat Co., Pittsburgh. The Pennsylvania Public Utility Commission recently approved the $3,231,000 transaction.

Both companies are subsidiaries of the Columbia Gas System Inc., New York, and they provide service in parts of West Virginia and Ohio as well as in Pennsylvania.

Manufacturers will assume liability of $1.8 million in promissory notes as part payment. The commission also issued a securities certificate permitting Manufacturers to issue notes to pay the balance of the purchase price and to obtain an additional $6 million for construction.

Revenues Score 25% Gains

Natural gas company operating revenues were $81.9 million in June, an increase of 25.4% over totals for the same month last year, according to FPC announcement.

Gas utility operating income for the

GROWTH IN GAS AND ELECTRICAL CUSTOMERS

	1950	1940	Increase Actual	Increase Percent
Population	149,829,400	131,669,300	18,160,100	+ 13.8
Occupied dwellings	42,100,000	34,854,000	7,246,000	+ 20.8
Residential gas customers as of Jan. 1				
City	21,933,000	16,435,000	5,498,000	+ 33.5
LP-Gas	5,150,000	800,000	4,350,000	+543.8
Total	27,083,000	17,235,000	9,848,000	+ 57.1
Residential electric customers as of Jan. 1	37,179,700	24,599,300	12,580,400	+ 51.1
Residential gas customers as of Jan. 1—percent of occupied dwellings				
City	52%	47%		
LP-Gas	12%	2%		
Total	64%	49%		
Residential electric customers as of Jan. 1—percent of occupied dwellings	88%	71%		

"TEXAS TESSIE," strictly a natural gas girl, showed up at Atlantic City's Miss America Pageant last month and held her queenly own in the midst of the all-American pulchritude. Above, Tessie and Reddy Kilowatt ride a parade as "partners in free enterprise." Behind them are replicas of the Liberty bell and the Constitution, carrying out the "freedom" theme. South Jersey Gas Co. and Atlantic City Electric Co. jointly sponsored the float.

At left, Miss Texas presents a tank of natural gas to the flesh-and-blood Texas Tessie, portrayed by Jane Wychgel, as South Jersey Sales Manager Hugh Wathen beams approval. It was the first Texas gas to reach Atlantic City, heralding the promise of 18 MMcf-per-day deliveries starting late this year.

month of June 1950, $12.8 million, was 50.5% above the $8.5 million reported for June 1949. Net income was up even more: $10.1 million for June this year; $5.1 million for June 1949.

Gas operating revenue reduction amounted to $69.2 million (up 21.9%) and of this, operating expenses formed $52.9 million (up 20.7%), depreciation was $7.7 million (up 11.1%), and reserve for taxes was $8.6 million (up 42.9%).

For the 12 months ended June 1950, gas operating revenues aggregated $1,090,839,399, an increase of 16.9%.

FPC Remodels Account Reports

On Jan. 1, 1951, changes in the FPC "Uniform System of Accounts for Natural Gas Companies" will become effective. The revisions are based on the commission's experience during the last 10 years and were necessitated by industry developments since adoption of the system in 1939.

The amendments will provide for inventories of gas in underground storage and for account classifications for storage plant and expenses, relocation and better accounting for products extraction operations, and improvements in plant and expense categories.

Financial Footnotes

Annual rate increases of $6.1 million recently were granted to Southern California Gas Co., Los Angeles, by the California Public Utilities Commission. This includes the $5.7 million yearly boost given the company on an interim basis last February, at which times rates were raised accordingly. Actually, about 1 million domestic consumers will pay approximately $3.8 million of the total $6.1 million additional yearly bill. The balance of the raise will be billed to industrial users.

An initial decision which would disallow part of the proposed increase in rates for wholesale natural gas service by The Ohio Fuel Gas Co., Columbus, was filed Aug. 25 by the FPC presiding examiner. The examiner found that the firm's proposed boost from 2.41 to 2.7 cents per Mcf has not been proved "just and reasonable," but he recommended that an increase of 0.135 cents (to 2.545 cents per Mcf) would be "just, reasonable, and lawful." The decision is subject to review by the commission.

MANUFACTURERS

Perfex Adds to Canadian Plant

Perfex Controls Ltd., Canadian subsidiary of Perfex Corp., Milwaukee, has announced addition of a new manufacturing plant at Guelph, Ontario.

The plant will contain 18,000 sq ft for the manufacture of Perfex thermostats, electric time switches, air limit controls, fan controls, pressure, vapor, and vacuum controls, transformer relays, solenoid gas valves, and damper controls for hand-fired heating units.

Construction of the new plant is the first step in an expansion of the Canadian branch of the company that will include erection of two more large plants at Guelph, which is to be the manufacturing center for the entire Canadian operation. E. G. Spall is president and general manager for Perfex Controls Ltd. Murray Bowman is vice president in charge of sales.

Contracts Let for Conversion

Contracts for the conversion of water gas manufacturing equipment of Montreal Coke & Manufacturing Co. (Canada) to the use of heavy oils for enrichment have been awarded to By-Products Coke Co. of Canada Ltd., a Koppers Co. Inc. subsidiary.

Actual construction will be carried out by By-Products Coke, with a design assist from the engineers of Koppers' engineering and construction division.

Montreal Coke & Manufacturing sells gas to Hydro-Quebec for distribution to industrial and domestic customers.

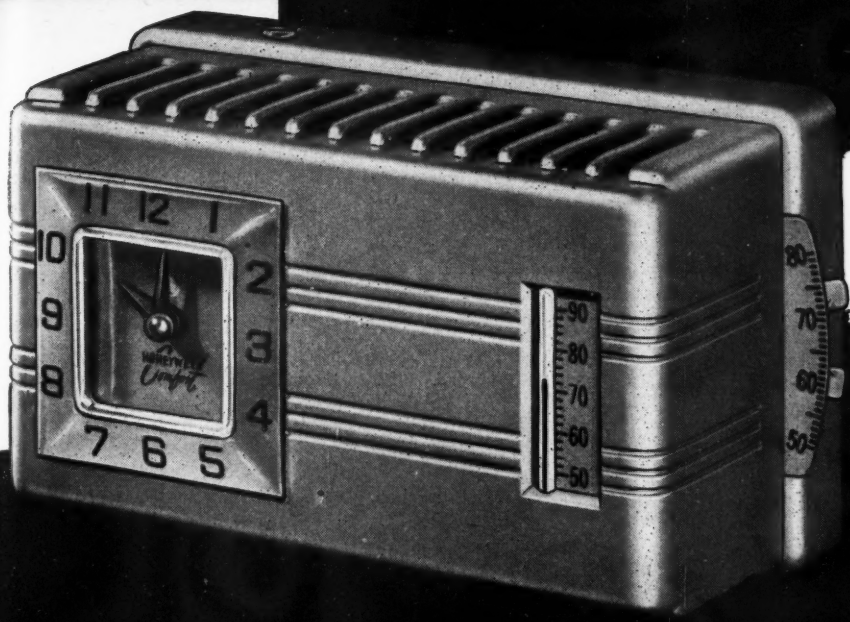
Notes

A $1 million modernization program, including a new kiln, cast shop, warehouse, and enlargement of the office, is to start Dec. 1 at American Radiator & Standard Sanitary Corp.'s Tiffin, Ohio, pottery. Production of vitreous china plumbing fixtures will be increased by 10%. The program is to be completed before the end of 1951.

Alabama By-Products Corp., which operates a large foundry coke and coal-chemical plant at Tarrant, Ala., near Birmingham, has awarded Koppers Co. Inc. a contract to construct a battery of 29 new chemical-recovery coke ovens. To be completed within a year, the battery will produce 150,000 tons of coke annually.

Use of aerial photography to check tonnages of coal stockpiles has been announced by Philadelphia Electric Co. The company claims that it is the first to use this means of gauging its reserves.

Cubical content of the stockpiles will be computed after careful mathematical calculations on the aerial views of the reserves. Philadelphia has 10 stockpiles of coal at its electric generating stations, gas manufacturing plants, and steam stations.



it's Thermostat Magic

EASIER TO SELL

ELIMINATES STOCKING PROBLEMS

NEW SIMPLIFIED INSTALLATION

MAKES INVENTORY SIMPLE

NO MORE MATCHING OF HEATERS

Now, FOR THE FIRST TIME....

One Chronotherm packaged two ways for your convenience. The TM 848A Plug-In for replacement jobs — the TM 850A for all new or concealed wiring installations. Makes stocking, selling and installation . . . Simple as A B C.

....INCREASE YOUR SALES!

MISCELLANY

New Househeating Freezes Sought in Midwest

Househeating demand is running ahead of supply again.

In two separate cases last month, this hard fact came to light. In Columbus, Ohio, five companies serving more than 1 million customers asked the state public service commission for authority to restrict new installations, while in Washington, Panhandle Eastern Pipe Line Co. was facing the same old problem again—not enough gas for its customers. Once more, FPC staffers were trying to set up an equitable allocation system to prevent hardship.

The Ohio companies—Ohio Fuel Gas Co. of Columbus, East Ohio of Cleveland, Cincinnati Gas, Manufacturers Light & Heat, and Dayton Power & Light—have already installed an aggregate of 188,000 new heating systems, and they figure they've already strained the limit.

East Ohio and Ohio Fuel both sought limitations on everything but new construction. Cincinnati Gas and Manufacturers wanted a complete freeze, and Dayton asked a ban on everything but new starts within the following 30-day period.

Panhandle's demands for the winter appear to be 621 MMcf on a peak day, against a capacity of 550 MMcf. Large chunks of the industrial load may have to be chopped off on heaviest demand days.

* * *

The New York Public Service Commission has slapped sharp restrictions on the extension of gas heating in the Binghamton area. Binghamton Gas Works received orders from the commission to cease issuing space heating unit permits except in cases of new construction and in so-called medical hardship cases. Robert E. Williams, district manager of the gas works, said that the PSC order probably will block area householders from converting to gas heat until May 1, 1951.

Complete Securities Data Compiled in New "Gas Facts"

An important addition to this year's edition of *Gas Facts*, recently published by the AGA Bureau of Statistics, is a comprehensive section on security issues for the entire period since 1937. Previously, this portion of the book included only issues reported by the SEC for companies subject to its jurisdiction. The expanded statistics include all gas utility security issues for which records could be found.

The annual statistical volume presents the usual information relating to operating and financial developments within the industry —natural gas reserves, production, customers, sales and revenue trends, construction expenditures, composite balance sheets and income accounts for straight and combination utilities, and miles of main.

Copies are available from the AGA Bureau of Statistics at $1 each.

Instrumentation Study Scheduled

A number of industrial concerns manufacturing oil, gas, and chemical products are cooperating with the Agricultural and Mechanical College of Texas, in presenting the fifth annual symposium on "Instrumentation for the Process Industries." The meeting will be held Oct. 11-13 at College Station, Texas.

Manufacturers of instruments and automatic controls are providing educational exhibits and lecturers for many of the sessions. Subjects to be discussed include measurement and control of temperature, pressure and liquid level; time control, and the relationship between practice and basic control theory.

CALENDAR

OCTOBER

AGA Annual Convention and GAMA Exhibition of Gas Appliances and Equipment—Atlantic City, N. J., Oct. 2-6.

Texas Mid-Continent Oil & Gas Assn. Convention—Dallas, Oct. 4-5.

National Assn. of Corrosion Engineers — South Central Regional Meeting, Rice hotel, Houston, Oct. 9-10.

National Safety Congress & Exposition—Chicago, Oct. 16-20.

Independent Natural Gas Assn. of America Annual Meeting—Shamrock hotel, Houston, Oct. 23.

National Metal Exposition—Amphitheatre, Chicago, Oct. 23-27.

Natural Gasoline Assn. of America Southern Regional Meeting—Blackstone hotel, Tyler, Texas, Oct. 27.

NOVEMBER

National Hotel Exposition—Grand Central Palace, New York, Nov. 6-10.

Wisconsin Utilities Assn. Gas & Electric Section Convention—Schroeder hotel, Milwaukee, Nov. 8-10.

Mid-Southeastern Gas Assn.—The Sir Walter hotel, Raleigh, N. C., Nov. 9-10.

American Petroleum Institute Annual Meeting—Los Angeles, Calif., Nov. 13-16.

New Jersey Utilities Assn. Annual Meeting—Seaview Country Club, Absecon, N. J., Nov. 17-18.

American Society of Mechanical Engineers Annual Meeting—Hotel Statler, New York, Nov. 26-Dec. 1.

AGA-SGA Employee Relations Conference—New Orleans, Nov. 27-28.

DECEMBER

The American Society of Refrigeration Engineers—Hotel Commodore, New York, Dec. 3-6.

Institute of Cooking and Heating Appliance Manufacturers Semi-Annual Meeting—Cincinnati, Dec. 4-6.

JANUARY 1951

AGA Home Service Workshop—Hotel Statler, Washington, D. C., Jan. 3-5.

Pipe Line Contractors Assn. Annual Convention—Shamrock hotel, Houston, Jan. 9-10.

MARCH

Mid-West Gas Assn.—Hotel Fontenelle, Omaha, March 12-14.

National Assn. of Corrosion Engineers Conference & Exhibition—Hotel Statler, New York, March 13-16.

Gas Appliance Manufacturers Assn. Annual Meeting—The Homestead, Hot Springs, Va., March 19-21.

New England Gas Assn. Annual Meeting—Hotel Statler, Boston, March 29-30.

APRIL

AGA Sales Conference on Industrial & Commercial Gas — Shoreham hotel, Washington, D.C., April 2-4.

Mid-West Regional Gas Sales Conference, Residential Gas Section—Edgewater Beach hotel, Chicago, April 9-11.

Southwestern Gas Measurement Short Course—University of Oklahoma, Norman, April 10-12.

AGA Distribution, Motor Vehicle, and Corrosion Conference—Hotel Peabody, Memphis, April 16-18.

Southern Gas Assn. Annual Meeting —Biloxi, April 23-25.

National Conference of Electric and Gas Utility Accountants—Hotel Sherman, Chicago, April 23-25.

Indiana Gas Assn. — French Lick Springs, French Lick, Ind., April 26-27.

MAY

AGA Natural Gas Department Spring Meeting—Dallas, May 7-8.

Pennsylvania Gas Assn.—Wernersville, Pa., May 14-16.

AGA Production and Chemical Conference—Hotel New Yorker, New York, May 14-16.

Public Utilities Advertising Assn. Convention—Hotel New Yorker, New York, May 17-19.

JUNE

Institute of Cooking and Heating Appliance Manufacturers Annual Meeting—Cincinnati, June 5-6.

Canadian Gas Assn.—Bigwin Inn, Lake of Bays, Ontario, Canada, June 18-21.

SEPTEMBER

Pacific Coast Gas Assn. Annual Convention — Fairmont hotel, San Francisco, Sept. 4-6.

This is test laboratory Number 39!

It could be right in your own neighborhood . . . one of the typical American homes in which Bryant has a test installation. Here, new features and equipment qualify under actual service conditions, make it possible for our dealers to sell truly *home-tested* heating.

These test homes have helped us to make equipment that is more efficient and more economical in operation, that requires less servicing. Through them, we have developed improvements that make it more profitable for dealers to *sell* and your gas users to *buy* Bryant automatic gas heating.

There's a Bryant distributor nearby, too, with warehouse stock which includes most everything in gas heating, from circulators to furnaces, from water heaters to boilers. There's engineering aid for the dealers' tougher jobs, co-operative advertising assistance for their localized campaigns.

Yes, Bryant meets the test . . . in home-proved equipment, in public preference, in working with our dealers. That's why gas utilities with the *most* Bryant installations along their mains have the *best-satisfied* customers.

Let the pup be furnace man
. . . and water boy, too!

bryant
AUTOMATIC HEATING

The most complete line of gas heating equipment in the nation

Bryant Heater Div., Dept. 188,
Affiliated Gas Equipment, Inc.,
17825 St. Clair, Cleveland, Ohio

( ) Send me the new booklet that tells the Bryant story. ( ) Have your distributor call on me.

Name_____

Company_____

Address_____

City_____ State_____

PEOPLE

W. H. Ashworth
... Hays

H. W. Jones
... Okla. Natural

W. E. Colvin
... Roper

M. W. Battersby
... Murray

WILLIAM H. ASHWORTH has been appointed sales representative in Virginia, Maryland, North Carolina, and the District of Columbia for Hays Manufacturing Co., Erie, Pa. Mr. Ashworth is a graduate of Virginia Polytechnic Institute.

HOWARD W. JONES, advertising manager of the Oklahoma Natural Gas Co., resigned recently to accept a position as account executive with Ketchum, MacLeod & Grove Inc., Pittsburgh advertising agency. Since joining the Oklahoma utility in 1939, Mr. Jones has won national recognition in the public utilities advertising field. He has headed the staff of the firm's employee magazine, the Oklahoma Natural *Gasette*, for the past 10 years.

H. EMERSON THOMAS, Westfield, N. J., recently was named to the board of directors of Pennsylvania & Southern Gas Co. Other members of the board are JOHN F. BUNN JR., Philadelphia; WILLIAM W. PRAGER, New York; THOMAS KENWORTHY, Philadelphia; and FREDERICK PHILLIPS, Marion, Pa. The new board elected Mr. Thomas as president and treasurer, Mr. Bunn as vice president, GEORGE R. WILLIAMS as secretary and assistant treasurer, and WILLARD P. BALDWIN as assistant secretary. WILLIAM H. NIX JR., formerly of Providence (R.I.) Gas Co., is now assistant to the president and general manager.

A. V. K. BABCOCK has been appointed manager of the Central Arizona Light & Power Co.'s new industrial development department. The department's aims are to attract new industries, to help existing ones to expand, and to work with groups who are interested in industrial development. Since January 1949 Mr. Babcock has been director of budget control.

RALPH B. STEVENS, 23-year employee of Milwaukee Gas Light Co., has taken over as manager of customer service. Although he has been connected with the sales department during most of his career with the company, Mr. Stevens revamped and modernized the service system several years ago.

ALVAH I. THOMPSON has been named assistant sales manager of the Barton Instrument Corp., Los Angeles. Mr. Thompson was formerly associated with the Bristol Co., Waterbury, Conn.

WILLARD E. COLVIN, eastern Pennsylvania district manager for George D. Roper Corp., has succeeded GORDON M. JONES as sales manager of Consumers Gas Co., Reading, Pa. Mr. Jones has moved to Philadelphia to take charge of sales and sales promotion activities for the subsidiaries of United Gas Improvement Co. RAY A. STONER, a long-time Consumers Gas employee, has been named assistant sales manager.

MARK W. BATTERSBY has been appointed Pacific Northwest district sales manager by the Home Appliance Division of The Murray Corp. of America, Scranton, Pa. He will headquarter in Seattle and will serve Washington, Oregon, Idaho, and Utah.

R. CHRIS NITSCHKE has joined Rockwell Manufacturing Co., Pittsburgh, as a project engineer on petroleum products. Mr. Nitschke was assistant chief engineer for Standard Vacuum Oil Co., headed his own consulting engineering firm, served as a petroleum specialist in the armed forces for three years, and was employed by M. W. Kellogg Co. and A. G. McKee Co. of Union, N. J., after the war.

WILLIAM H. BERG and ELMER LIND recently joined the G. S. Blodgett Co. Inc., Burlington, Vt., as sales representatives. Mr. Berg will headquarter in Cleveland and will cover Ohio, Michigan, western Pennsylvania, West Virginia, and Kentucky. Mr. Lind's territory includes Illinois, Indiana, Wisconsin, Iowa, Minnesota, and Omaha, Neb. He will be located in Chicago.

John C. Diehl

JOHN C. DIEHL recently was elected president of the American Meter Co., New York, by the board of directors. NORTON McKEAN, president since 1941, resigned because of ill health. Mr. Diehl joined the company as an engineer in 1919 and was elected chief engineer in 1929. In 1934 he was named vice president. He is a member of the AGA and GAMA and is the author of numerous technical articles and books on gas measurement.

ROBERT W. DUCKER and RUSSELL E. RITCHIE have been elected vice presidents of Stone & Webster Service Corp., New York. . . Morris Coupling & Clamp Co., Ellwood City, Pa., has announced the election of C. F. MARONEY as president and R. W. McGREW as secretary. . . J. THEODORE WOLFE, executive vice president of Consolidated Gas Electric Light & Power Co. of Baltimore, recently was elected a director of the company. . . The Timken Silent Automatic Division, Jackson, Mich., has appointed five new district sales managers. They are THOMAS McCLURE JR., northern Indiana; R. J. MACKAY, western New York; H. J. VAUGHN, western Pennsylvania; JOHN MEINERS JR., southern Indiana and Kentucky, and E. S. LeMOINE, eastern Canada.

ROLAND R. PAULIN has been promoted to vice president and assistant engineer of Michigan Consolidated Gas Co., Detroit. Mr. Paulin has been assistant manager of operations for the past year, and was commercial office manager for the previous five years. The company also announced the appointment of GEORGE C. OTTON as assistant treasurer. First employed by the firm in 1939, Mr. Otton's most recent position was that of assistant to the treasurer.

A. O. LEECH has been promoted to the position of gas sales manager of Portland (Ore.) Gas & Coke Co. He joined the company's utilization laboratory in 1921 and later became heating engineer and supervisor of

A. O. Leech

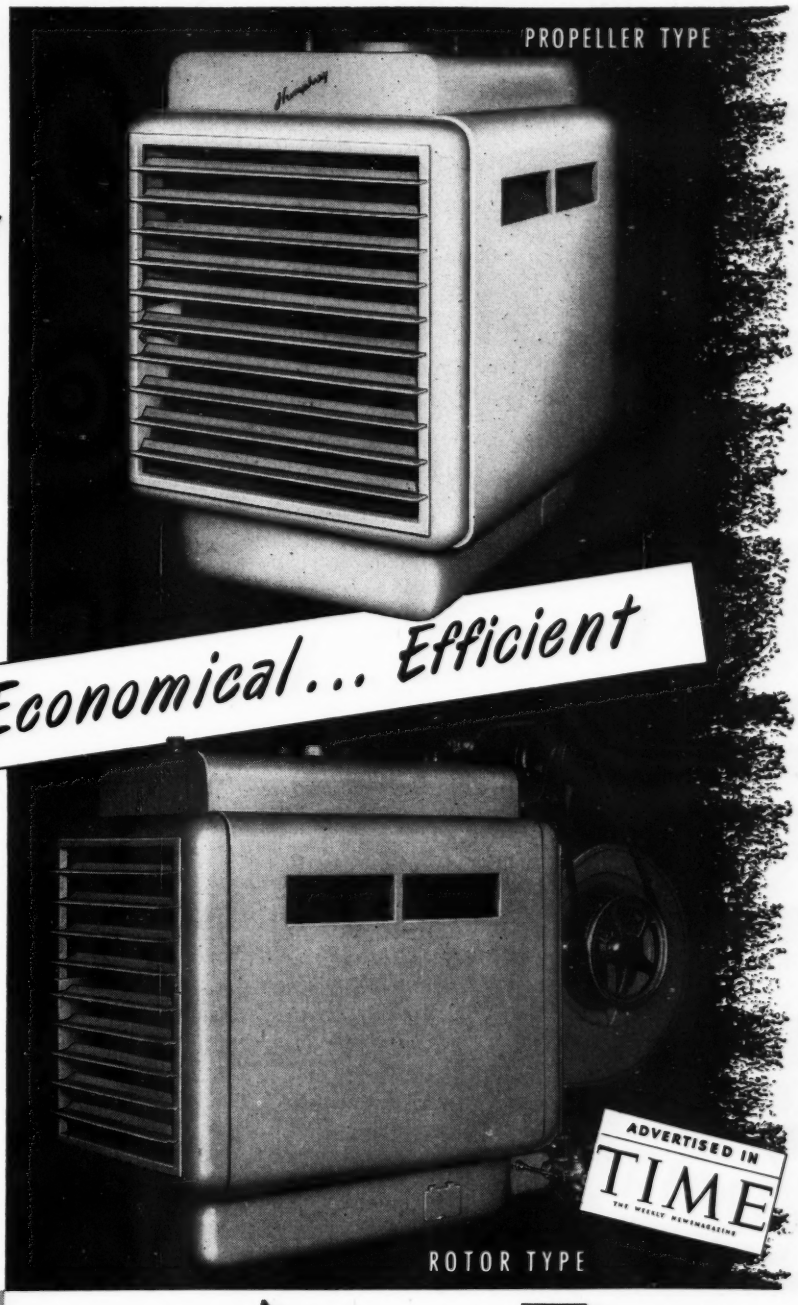
G. E. Healy

househeating sales. Mr. Leech's former position, commercial and industrial sales manager, has been filled by G. E. HEALY. Mr. Healy started in residential sales in 1927 and was supervisor of commercial and industrial sales at the time of his promotion.

GEORGE E. PAYNE, formerly with Central Indiana Gas Co., Muncie, has joined the George D. Roper Corp., Rockford, Ill., as a salesman. He will headquarter in Lincoln, Neb. LYNN J. BLUM has become a Roper representative in the Pittsburgh area and CHARLES R. BERRY JR. recently took over the territory in western Virginia and part of West Virginia. WILLIS A. FERGUSON has moved from office manager in Chicago to sales representative in that area.

ROBERT E. DALY has been named manager of the new San Francisco Pacific branch sales office of The National Radiator Co., Johnstown, Pa. For the past 18 years Mr. Daly has been the firm's northwest sales representative with offices in Seattle. HERBERT VAN KURAN has succeeded Mr. Daly in Seattle.

Humphrey GAS UNIT HEATERS

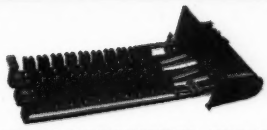


Dependable... Economical... Efficient

The demand for gas fired unit heaters is increasing steadily because of their many *plus* advantages . . . advantages that include saving of floor space, economical installation and operation, cleanliness, elimination of boilers and fuel storage. Humphrey Gas Unit Heaters are the finest that over 50 years experience in building gas heating equipment can produce . . . when you sell a Humphrey, you sell complete customer satisfaction.

Available in sizes from 65,000 to 200,000 BTU input ratings; Rotor Type available with louvers or duct adapter.

ONLY Humphrey HAS ALL THESE ..... QUALITY FEATURES



SUPER COMBUSTION CHAMBER — Completely new, all steel with special stainless steel lifetime "dual flame" burner tips.

POSITIVE SAFETY CONTROLS—Basoid Safety Pilot shuts off gas in event of pilot outage, Humphrey overload assembly eliminates danger of overheating due to any cause.

ADJUSTABLE LOUVERS — Horizontal or vertical louvers available . . . easy control of angle at which heat is directed downward at desired level.

FREE FLOW HEAT EXCHANGER — Heavy gauge steel, welded for strength and gas-tight construction. Large area, streamlined surface, effects rapid transfer of heat. No baffles to impede flow. Requires no cleaning.

Radiantfires

Circulators

GENERAL GAS LIGHT COMPANY

KALAMAZOO, MICHIGAN

Wall Heaters

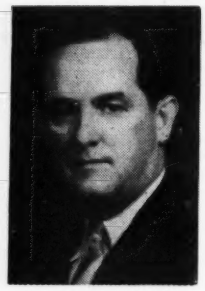
Unit Heaters

C. Lockhart Jr.

... Bryant

C. E. Baird

... Blaw-Knox



H. M. Rabold

... Ky.-W.Va.

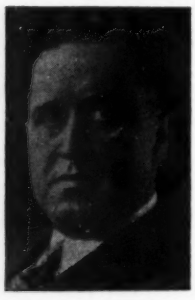
C. H. Nist

... Equitable

CHARLEY LOCKHART JR. has been named assistant to J. H. Swallow, southern district sales manager of Bryant Heater Division, Cleveland. At the time of his appointment, Mr. Lockhart was manager, dealer sales department, general division, Lone Star Gas Co.

CARL E. BAIRD has been appointed manager of the Tulsa office of the chemical plants division of Blaw-Knox Co., Pittsburgh. Mr. Baird has been associated with the company since 1946.

MISS RITA McINTYRE, home economist for the past year at the Washington, Pa., office of The Manufacturers Light & Heat Co., Pittsburgh, has been named to the same position for the Cumberland & Allegheny Gas Co. in the Cumberland, Md., territory. DOROTHY CRAWFORD has succeeded Miss McIntyre at Washington. Other home economists recently appointed by Manufacturers include JEAN SIMPSON in the Martins Ferry, Ohio, territory and JANET JONES in the Allentown section of Pittsburgh.



George E. Welker

GEORGE E. WELKER, president of United Natural Gas Co. and affiliated companies, Oil City, Pa., resigned that position effective Sept. 1 but will continue for a few months as a director and advisor. Mr. Welker became chief engineer and geologist for United and consulting engineer for the other companies in 1918. He was elected vice president and director of United in 1924 and president in 1927.

JOHN P. CONDE has been appointed advertising and sales promotion manager of the Brady-Milwaukee Division of W. H. Brady Co., Chippewa Falls, Wis., manufacturer of wire, pipe, and conduit markers and die cut masks. Mr. Conde, who will be located at Milwaukee, was formerly advertising manager of the Askania Regulator Co.

CHARLES B. DENTON has been named advertising manager of the Tagliabue Instruments Division, Weston Electrical Instrument Corp., Newark, N. J., and PHILIP BARNES has been appointed general sales manager. They have been associated with the company for 25 and 16 years, respectively.

HUGH M. RABOLD has been elected assistant secretary and appointed general auditor of Kentucky West Virginia Gas Co., Ashland, Ky. Mr. Rabold has been auditor of the company for the past 12 years.

C. H. NIST has been appointed assistant to President A. W. Conover, Equitable Gas Co., Pittsburgh. Mr. Nist joined the company in 1924 and has since served as secretary to the vice president and general manager and as office assistant to the president. JOHN R. LEGGATE is the company's new manager of customer service, general sales department.

IRA D. FINDLEY has been named an industrial engineer in the gas distribution department of The Manufacturers Light & Heat Co., Pittsburgh. Mr. Findley was succeeded as local manager in the Beaver Falls, New Brighton, and Rochester, Pa., area by PAUL K. KUZMA. PAUL M. ALLEN JR. has replaced Mr. Kuzma as district engineer.

The company's gas engineering department has announced the employment of three recent university graduates under the cadet engineering program. They are JOHN E. FURBEE and J. CARL BOVANKOVICH, chemical engineers, and FRANK E. FULTON, a petroleum engineer.

CALVIN O. WILLIAMS, linguist and foreign relations specialist, has been appointed executive secretary of Southwest Research Institute's International Division. Mr. Williams was formerly a staff member of the San Antonio institute's affiliate, Institute of Inventive Research. JOHN A. P. OHMAN, specialist in the building of industrial process instrumentation, has been appointed a senior research engineer in the physics department at Southwest.

A. W. BREELAND has been appointed assistant director of personnel for Lone Star Gas Co., Dallas. In addition to his new work, Mr. Breeland will continue to supervise and coordinate the safety training programs of the company.

MISS ELEANOR JONES, supervisor of lectures and demonstrations on the home service staff of the Ohio Fuel Gas Co., Columbus, during 1946 and 1947, has been named assistant home equipment editor for *American Home* magazine.

A. A. ENGLEHARDT, a member of the sales organization of Eclipse Fuel Engineering Co., Rockford, Ill., for 14 years, has been appointed district sales representative at Chicago.

HOWARD S. ROSE, secretary and treasurer of United Natural Gas Co., Oil City, Pa., and affiliated companies, has been elected president of the organization, succeeding GEORGE E. WELKER, who resigned. M. J. TALLEY, assistant secretary and assistant treasurer since 1923, has replaced Mr. Rose. Both men are members of the board of directors. As a result of organizational changes, the following promotions have also been announced: G. F. GEARHART to superintendent of transmission compressor stations, CHARLES E. WILLIAMS to superintendent of transmission mains, DONALD T. SECOR to superintendent of production and underground storage, HARRY A. GOODMAN to assistant superintendent of distribution, WILLIAM T. WARDWELL to distribution foreman in Meadville, Pa., and FRED A. ROSSEY to distribution foreman in DuBois, Pa.

GLEN E. FOSTER was elected vice president of The Brooklyn Union Gas Co. at a recent meeting of the board. Mr. Foster joined Brooklyn Union in 1933 as an assistant auditor, became comptroller in 1937, and assistant vice president in 1945. He is an AGA member and served as president of the Controllers Institute in 1942.

ROBERT J. CANNIFF, advertising and sales promotion manager for Servel Inc., Evansville, Ind., has been named director of advertising and public relations, and CHARLES F. PEARSON, former assistant sales promotion manager at Hotpoint Inc., Chicago, has been named sales promotion manager. Mr. Canniff has been associated with Servel for

R. J. Canniff

C. F. Pearson

10 years and is an active AGA member. The company also announced the promotion of RAY COOPER to district sales manager for the state of Oklahoma. Since his separation from the army in 1946, Mr. Cooper has worked as a water heater and appliance sales specialist out of the Dallas office.

OTTO W. MANZ JR. has been appointed manager of the system operation department of Consolidated Edison Co. of New York Inc. Mr. Manz has been placed in this position after serving throughout the system under the company's executive development program.

HUGH H. CUTHRELL, vice president of Brooklyn Union Gas Co. and AGA president, is serving as chairman of the Brooklyn division of the 1950 Fund Appeal for the Travelers Aid Society of New York. More than 100 New York business and professional leaders are participating in the drive.

F. WHITWORTH recently was appointed works manager of the Sprague Meter Co., Bridgeport, Conn. Simultaneously, it was announced that CHARLES STEWART, research engineer, succeeds Mr. Whitworth as chief engineer, a position he had held since

Charles Stewart

F. Whitworth

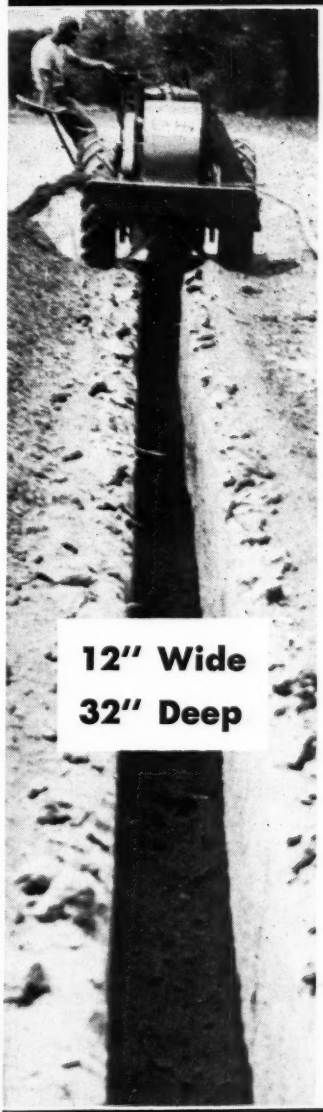
1944. Mr. Whitworth is the inventor of several patented features of his company's products, and Mr. Stewart was largely responsible for the development of Sprague's combination meter and regulator. Both men were formerly associated with San Diego (Calif.) Gas & Electric Co.

DR. E. W. VOLKMANN and DR. F. L. JONES have been appointed as assistant managers of the research department, Koppers Co. Inc., Pittsburgh. Dr. Volkmann is in charge of the laboratory and development sections, and Dr. Jones is supervising the research administration and patents sections.

ROY G. MUNROE, superintendent of the dealers' and builders' department for the Public Service Co. of Colorado, Denver, and HERBERT P. TEWKSBURY, senior clerk in the purchasing department, recently were awarded 50-year service pins. Among the positions Mr. Munroe has held with the company are head of the industrial gas department, assistant commercial manager, and gas new business manager. He is an active member of the Rocky Mountain Gas Assn. and is currently secretary-treasurer of the organization.

Fifty-year service awards were presented at ceremony in office of John E. Loiseau, president and general manager (left). Mr. Munroe is standing and Mr. Tewksbury is at right.

Digging 1400-foot ditch



IN 2½ HOURS

The illustration shows a Longhorn Mobile Ditcher at work on a real estate development in Owensboro, Kentucky. The job illustrated was a 12" wide, 32" deep ditch. This 1400-foot ditch was dug in 2½ hours.

The new improved Model "B" Longhorn Mobile Ditcher has many added values that mean increased utility, operating economy, performance and dependability, and minimum maintenance cost.

Power increased 25%. More weight. Frame is heavier – reinforced and strengthened. Anti-friction bearings and heat-treated gears assure smooth performance.

The Longhorn Mobile Ditcher is one-man operated. All controls, including hydraulically operated hip action, are within easy reach of operator. Widely used for distributor main and service extension jobs. Readily moved under its own power from one work area to another.

There are numerous other features of a Longhorn Mobile Ditcher *that it is to the interest of you and your company for you to know about.* Please ask us.

LONGHORN INDUSTRIES, INC.
Henderson, Texas **Phone 1035**

NEW IMPROVED MODEL "B"
Longhorn Mobile Ditcher

CHARLES A. ANDERSON has been appointed supervisor of customer accounting for all divisional units of The Peoples Natural Gas Co., Pittsburgh. He was formerly a member of the internal auditing staff.

- OBITUARIES -

A. VOLNEY FOSTER, 73, president of Gainesville Gas Co. and Palestine Light & Power Co., both in Texas, and a director of the North Shore Gas Co. of Waukegan, Ill., and the North Continent Utilities Corp. of Chicago, died Sept. 4.

MILAS E. SMITH, who was associated with the gas industry for most of his business career and was Chicago district manager for the Welsbach Co. of Glouster City, N. J., until his retirement a few years ago, died Aug. 6 at his home in Elwood, Ind.

ROSS J. BEATTY, who pioneered in the natural gas fields in northern Indiana and was one of the first officers of the Inland Steel Co., died recently at the age of 96.

WALTER L. H. GELDERT, Orange county division sales supervisor for Southern Counties Gas Co., Los Angeles, died on Aug. 28 of a heart attack.

FRANK A. THROCKMORTON, retired superintendent of the Richmond (Va.) Gas Works, died Aug. 13. He was 70 years old.

Announcing a new
GLASS-LINED BALL TANK*
automatic Gas Water Heater

FEATURING

- No central flue
- Spe-Dee recovery
- Low standby loss
- Low stack temperature (300° F)
- Long life
- Guarantee...5 and 5

Also makers of 2 AGA approved conversion heaters

*On display at AGA Convention
Atlantic City

DOWNS ENGINEERING COMPANY
Springfield, Massachusetts

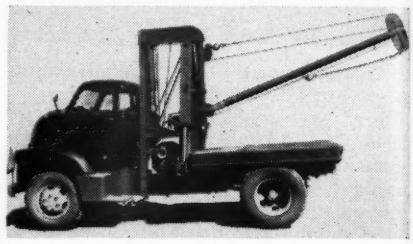
NEW PRODUCTS

Truck Crane

PITMAN MANUFACTURING CO., 300 W. 79th Terrace, Kansas City 2, Mo.

MODEL: Hydra-Lift.

DESCRIPTION: Smooth, positive hydraulic action enables operator to pick up and set down loads exactly where he wants them without slipping or over-swing. The boom swings in 180° arc and speed of swing can be regulated by driver from the cab. The



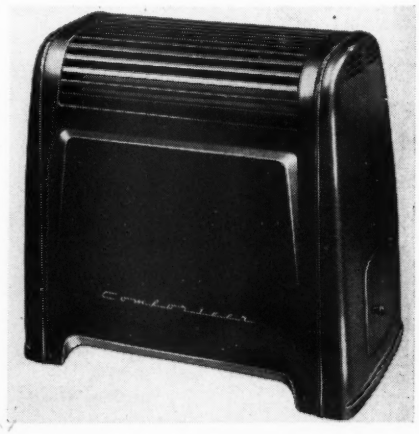
boom (which can be telescoped from 11 to 16 or 20 ft) can be used for straight line pull, and when in full upright position, can be used to load and unload off truck bed. Outriggers are adjustable in height to allow for uneven terrain. Capacity of Hydra-Lift varies from 6000 lb with the boom at 11 ft to 2500 lb with the boom at 20 ft. The crane requires only 35 in. of space behind the cab and can be installed on any type truck frame with a few bolts.

Heater

INLAND STEEL CONTAINER CO., 325 N. Cortez St., New Orleans.

MODEL: No. 320-S Comforteer.

DESCRIPTION: This AGA-approved, 20,000-Btu, direct-type vented circulating heater uses natural, manufactured, mixed, or LP-Gas. Individual orifices are provided to



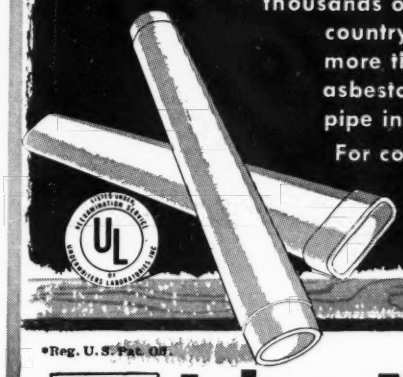
maintain proper fuel flow automatically and to eliminate the need for special adjustments.

The 320-S is 21 x 21 x 14½ in. deep. Its single-piece burner and mixing venturi is made of cast iron with slotted, raised port construction. Automatic control equipment is available for dealer installation.

OVER 50,000,000 ft IN SERVICE!

For more than 20 years, Johns-Manville Transite* Flue Pipe has proved its dependability and economy in thousands of installations throughout the country. To date, there have been more than 50,000,000 feet of this asbestos-cement pipe used for flue pipe installations!

For complete details, write for Folder TR-84A. Address Johns-Manville, Box 290, New York 16, N. Y.



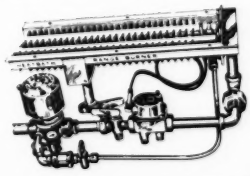
*Reg. U. S. Pat. Off.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE FLUE PIPE

FOR VENTING DOMESTIC GAS-BURNING APPLIANCES

24 leading gas range manufacturers are installing Heatbath Luminous Flame Burners as standard equipment in their kitchen heating models. These burners—precision-built, thermostatically-controlled and fully guaranteed—*will burn manufactured, natural, mixed and high B.T.U. Oil gas with only the easy change of the burner orifices.* Conversion models, also fully automatic, are available for any type of coal or oil fired ranges. Full-luminous models for LP gas, too!



Model LD-40 for Dual or Combination Ranges

HEATBATH APPLIANCES, INC.
SPRINGFIELD 1, MASS.

SHOPPING FOR BLOWERS?

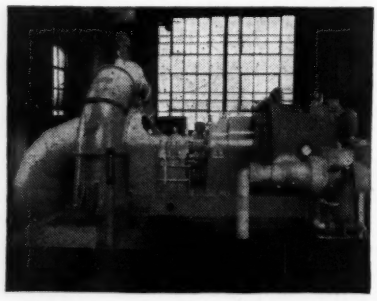
Look at *R-C dual-ability* with its wide selection to suit almost any job

Asking Roots-Connersville about blowers, exhausters and gas pumps has been standard practice among buyers for almost a century. That's because building such equipment is the only job we do. We're outstanding specialists in handling gas and air.

You'll gain from our wide varieties of sizes, types and capacities from 5 cfm to 100,000 cfm. We're the only manufacturers offering you the *dual-choice* between Centrifugal and Rotary Positive designs—and that *dual-ability* is important when it comes to matching the units to the jobs to be done.

So—when shopping, be sure to call on Roots-Connersville, the specialists. When you're interested in vacuum pumps, meters or inert gas generators, we're equally well fitted to fill these needs, too.

ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Oregon Avenue, Connersville, Indiana

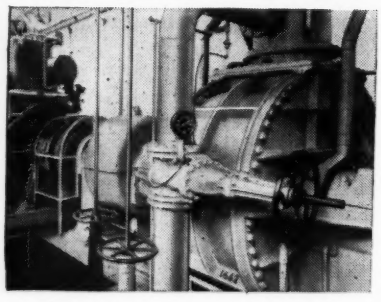


CENTRIFUGAL

Single-stage, Type OIB Gas Exhauster in gas utility plant. Capacity 39,950 cfm.

Rotary Positive Gas Pump driven by Clark Bros. Gas Engine in eastern plant. Capacity 20,833 cfm.

ROTARY



ROOTS-CONNERSVILLE

BLOWER BUILDERS SINCE 1854

ONE OF THE DRESSER INDUSTRIES

Truck Hoist

HOIST-O-MATIC CO., Kansas City, Mo.

MODEL: Hoist-O-Matic.

DESCRIPTION: This electrically powered mast-and-boom cable lift is rated for a straight vertical lift of 1000 lb or for a lift or pull of 2000 lb with split block and half

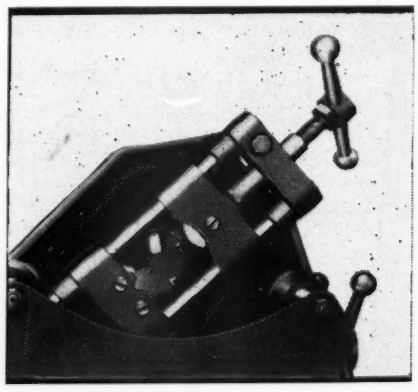
tackle. It is powered by a patented reversible motor which is enclosed in a housing beneath the truck bed. Remote push-button control is an unusual safety feature, and the 6-ft mast is topped by a 4-ft horizontal boom which swings through 360° for easy pick-ups or drops over the back or side of the bed. The wire cable travels at 6 in. per second, and 40 ft of cable is provided with every Hoist-O-Matic.

Pipe Cut-Off

TOLEDO PIPE THREADING MACHINE CO., Toledo, Ohio.

MODEL: Cut-off for No. 999 Super model 2-in. power pipe machine.

DESCRIPTION: Either wheel and roller cut-off or knife cut-off is available. With the wheel type, the cutter head is equipped with



two rollers and one cutter wheel which is self-centering and easily fed with hand wheel. This device cuts off pipe rapidly, leaving a clean cut. If a knife cut-off is preferred, the machine is furnished with four cutter knives which leave a straight square-end cut without burr. Blades are fed through a scroll by a small hand wheel, and they may be resharpened many times. With either type of cut-off, 2-in. pipe may be cut off in 10 seconds.

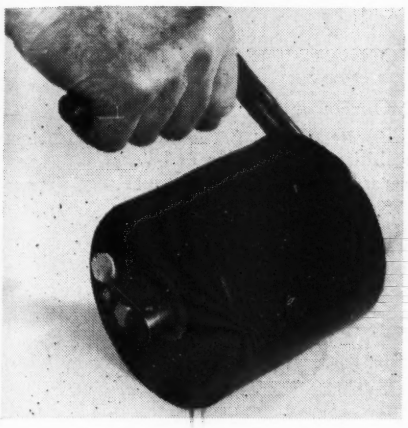
Anti-Corrosion Tape

MINNESOTA MINING & MANUFACTURING CO., 900 Fauquier St., St. Paul 6, Minn.

MODEL: Scotch electrical tape No. 22.

APPLICATION: For use on pipes from 3 to 36 in. in diameter, either above or below ground.

DESCRIPTION: Tape is applied by wrapping it around the pipe or joint, usually in a half-lap. Pressure-sensitive adhesive gives the tape adhesion to the pipe immediately upon contact. Dielectric strength is 10,000 volts, and insulation resistance is 50,000 megohms.



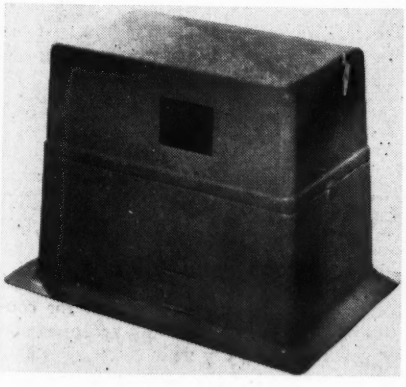
The tape has a black polyvinyl chloride backing. It is 10 mils thick, with a tensile strength of 30 lbs per inch of width. It has a "stretchiness" (elongation at break) of 125%.

Meter Housing

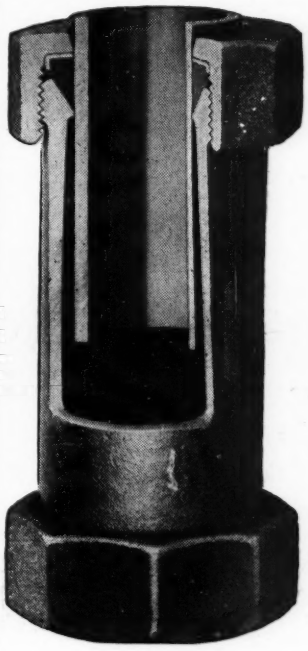
GORDON Z. GREENE CO., 2335 E. 8th St., Los Angeles 21, Calif.

MODEL: Residential meter and regulator house.

DESCRIPTION: This laminated Fiberglas resin cover and base provides permanent protection for meter and regulator assembly outside of the residence. It is light in weight, will not dent or chip, and reduces storage space through nesting of units. Service lines can be reduced in length and rust and corrosion do not occur. Elimination of metal parts insures long life.



NORMAC
COUPLINGS, SLEEVES and FITTINGS

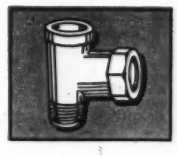


for maximum deflection, ease of "stabbing," complete confinement of the rubber!

So close are "Normac" rubbers confined at the gasket tip that possibility of flow is reduced almost to "nil." These couplings, sleeves and fittings . . . approved by gas utility men across the country for their time-saving features, ease of handling and dependable service . . . are available in a complete range of sizes. Made from air furnace malleable iron they provide greater wall thickness than pipe on which used.

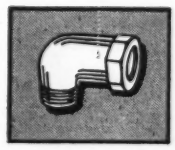
NORMAC COUPLINGS are made with 5" centers in all sizes. NORMAC SLEEVES are identical in design except that they are made with 10" centers. Nuts and gaskets are interchangeable.

COMPRESSION-END SERVICE "TEE"



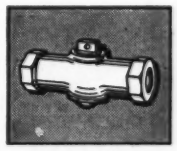
First fitting of this type ever produced with full coupling depth and special threads on male end to prevent dropping into old hand taps when used to replace standard threaded fittings.

COMPRESSION-END SERVICE "ELL"



Extra depth makes it possible to "stab" pipe into stops and without measuring, pull back a safe distance to allow ultimate deflection eliminating possibility of strain against tap in main.

COMPRESSION-END IRON BODY BRASS CORE SERVICE STOPCOCKS



End the necessity of threading on the job plus the elimination of the threads themselves — combining all the advantages of NORMAC COUPLINGS and the best in stopcock design. 2½" coupling depth on each end.

NORMAC BRASS FITTINGS DEVELOPED IN 1939 FOR USE WITH COPPER TUBING

Our complete line of brass fittings can be used either on new installations or where copper is run through old steel pipe in large or small openings. The center to end dimensions of NORMAC TEES correspond with old malleable iron fittings. This feature is extremely important in the use of these fittings in one foot openings where the tubing must line up with the steel which has been removed.

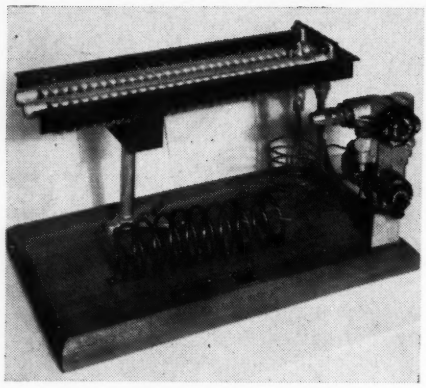
Write for the NORMAC CATALOG of Gas Distribution Equipment

NORTON-McMURRAY MFG. CO.

39 SOUTH LA SALLE ST. • CHICAGO 3, ILLINOIS

Couplings • Meter Bars • Sleeves • Cocks • Bell Joint Clamps • Service Tees & Ells

Gas Burner



HEATBATH APPLIANCES INC., Springfield, Mass.

MODEL: LD-40 double bar conversion burner.

APPLICATION: Recommended for high-Btu inputs on dual oven and coal ranges.

DESCRIPTION: The LD-40 burns with a clean, luminous flame with a high degree of radiating efficiency. It uses no primary air so will not entrain lint or other dusty, sooty matter into the burner tube. Large fins keep the burner cool, preventing breakdown and carbonizing of gases in the burner tube. The burner is lighted automatically by a stand-by pilot and temperature is maintained by automatic control, although a manual control thermostat is also furnished.

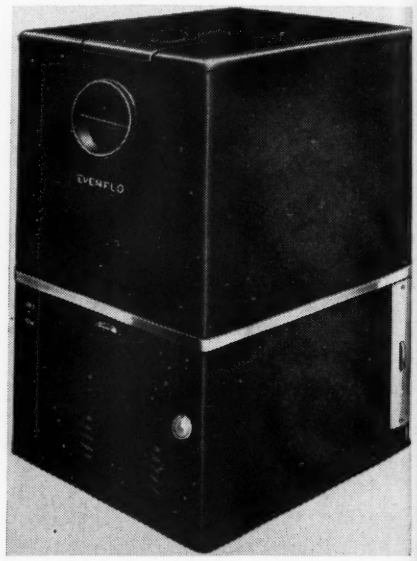
This model, as well as other Heatbath models except those designed for use with LP-Gas, features a new "wide angle" drilling principle. Drills enter the tube at an angle rather than being applied directly to the top of the arc formed by the circular shape.

Furnace

ECONOMY GAS FURNACE MFG. CO., 10 S. LaSalle St., Chicago.

MODEL: Evenflo.

DESCRIPTION: A modulated flame system stabilizes temperature and keeps heat even regardless of outside temperature. Flame never goes out. The self-contained furnace may be installed in utility room, attic, or basement. Jet burners have sufficient capacity for 4 to 8-room homes; a small air circulator is used for 4-room homes, and a change in the size of the circulator—*not* the size of the furnace—is required for larger homes. The furnace delivers up to 54,000 cu ft of cleaned air per hour through double filters and forced air system.



Cooler

WORTHINGTON PUMP & MACHINERY CORP., Harrison, N. J.

MODEL: Liquid sample cooler.

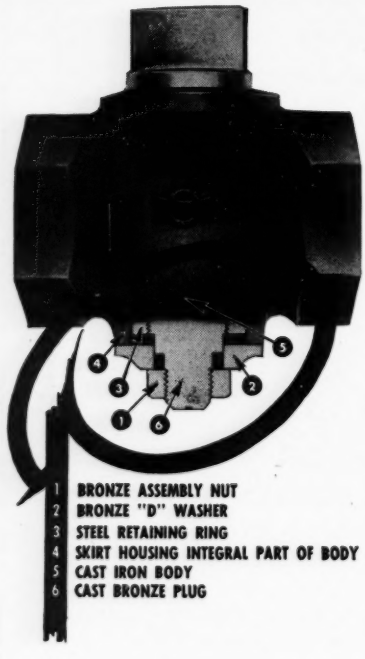
APPLICATION: For cooling boiler and boiler feedwater samples required for controlling chemical and refinery processes and for general laboratory use.

DESCRIPTION: This cooler is a shell and tubular coil type heat exchanger of all welded construction with all connections outside both cooling coil and jackets. Designed for 1500 psi and temperatures of 600°F on the cooling coil side, and 150 psi on the stainless jacket side, it has a 3⅜-in. OD and an overall length of 11¼ in. and is available in capacities of ¼ and ½ gpm.

HAYS®

TAMPER-PROOF GAS STOPS

FEATURES


1 BRONZE ASSEMBLY NUT
2 BRONZE "D" WASHER
3 STEEL RETAINING RING
4 SKIRT HOUSING INTEGRAL PART OF BODY
5 CAST IRON BODY
6 CAST BRONZE PLUG

- Tamper-Proof Design with Non-Removable Plug.
- Extra Grade Gray Iron Body, Gas Service Bronze Plug.
- Steel Retaining Ring Prevents Removal of Plug.
- Steel Retaining Ring Assembled to Bottom of Plug—Eliminates Possible Damage to Precision Ground Surface of Plug and Body.
- Steel Retaining Ring Threaded and Staked to the Largest Metal Diameter on Bottom of Tapered Plug—Assures Retention without Distortion.
- Steel Retaining Ring Anchored without Drill Hole or Pin—Eliminates Possible Shearing of Plug.
- Steel Retaining Ring Located below Shoulder of Body—Permits Freedom for Service Adjustment of Plug.
- Steel Retaining Ring Recessed and Inaccessible within Iron Body—Gripless and Shearless.
- Plug and Body Precision Ground and Matched for Perfect Seating.
- Individually Tested Under Rigidly Controlled Inspection.
- Lubricated with a Compound of Greases Suitable for Use with Manufactured, Natural or Liquid Petroleum Gases.
- Obtainable in a Variety of Patterns.

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AVAILABLE IN

Black or Galvanized

Flat Head Less Check
Flat Head With Check
Flat Head With Lock-Wing

Sizes; ¾"—1"—1¼"—1½"—2"

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HEAVY PATTERN IRON BODY
GAS STOP

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NEW *Permaglas* AUTOMATIC GAS WATER HEATERS SELL FOR NO MORE THAN ORDINARY WATER HEATERS !

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- Forget servicing headaches caused by tanks that rust or corrode. The *Permaglas* tank is unaffected by any and all water conditions.
- *Permaglas* is easier to demonstrate, easier to sell. Glass-surfaced steel tank with *Ceramitron* construction is exclusive, non-competitive, clinches the sale—quicker.
- New models in popular sizes at new low prices make MOST water heater prospects *Permaglas* prospects for you!

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From our strategically-located plants we are able to give quick delivery on high-quality ANCHORGAS, Butane-Propane. Shipments by rail, water or transport. For dependable gas service, call us before you renew your contract. Ask about Anchor's contract plan.

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ANCHOR PETROLEUM CO.

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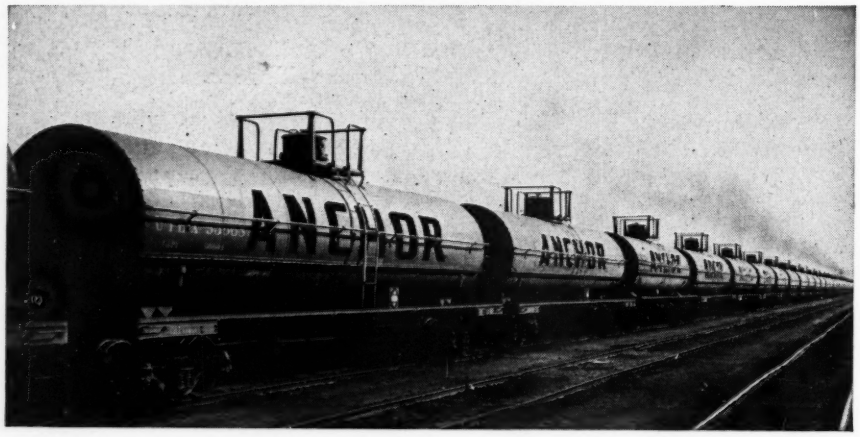

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A year 'round load builder.
2-bu. and 4-bu. sizes for homes and commercial installations.

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Safe, positive lighting. Choice of continuous pilot flame or manual control.

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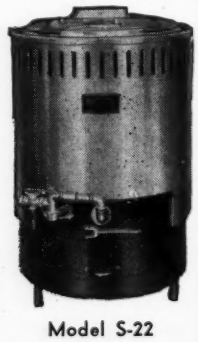

Model S-22

BOWSER, Inc., Incineration Division, Cairo, Illinois

BOOTH 739 A. G. A. CONVENTION HALL

TRADE LITERATURE

THE M. W. KELLOGG CO., 225 Broadway, New York 7—One new edition combining two volumes of charts on liquid-vapor constants and another covering fugacities for light hydrocarbons in mixtures have been published. The charts are based on the Kellogg "equation of state" and have been checked by application to multi-component experimental work in the Kellogg laboratories and in various universities. The volume covering pressures from 14.7 to 1000 psia is available for $20; an additional $10 will be charged for the volume of fugacity charts.

DRESSER MANUFACTURING DIVISION, Bradford, Pa.—A new 12-page catalog discusses Dresser flexible compression fittings which join the copper tubing or steel pipe without threading. They may be used for pipe cizes up to 2-in. Featured in the catalog is a two-page spread which illustrates the 12 specific applications where Dresser fittings give unique performance. Equipment designers and piping engineers will be interested in the unusual problems solved by these fittings.

FOSTER ENGINEERING CO., 835 Lehigh Ave., Union, N. J.—Bulletin FT describes the Foster "flow tube," a new development in primary elements for the measurement and control of fluid flow. The flow tube is essentially a differential producer which can be used with properly calibrated conventional recording, indicating, integrating, or control instruments. Flow tubes are made in three fundamental types and in all standard pipe sizes.

MINE SAFETY APPLIANCES CO., Pittsburgh 8, Pa.—Bulletin B-20 describes the company's Demand mask for dependable 30-min. respiratory protection in toxic or oxygen-deficient atmospheres. Included are complete details on the design and operation of this U. S. Bureau of Mines-approved, self-contained device. Also described is the front-type Demand mask which is carried on the wearer's chest and provides respiratory protection for 8 to 10 minutes.

DE LAVAL STEAM TURBINE CO., Trenton 2, N. J.—Bulletin G-WBV describes how "IMO-DeLaval" worm gears are manufactured, lists type of speed reducers, selection tables, horsepower ratings, overhung load rating tables, dimension tables, and includes a section on vertical speed reducers for cooling tower service.

E. J. LAVINO & CO., 1528 Walnut St., Philadelphia 2, Pa.—A new four-page brochure, bulletin D-117-A, explains the composition, properties, and applications of Kromepatch Chrome Bonding Cement. A copy of the bulletin will be sent upon request on business letterhead.

THE KITCHEN MAID CORP., Andrews, Ind.—"Kitchen Hints" is the title of a planning booklet which shows ten kitchen arrangements with new convenience features. Complete descriptions of the various Kitchen Maid units used are included.

Armstrong Propane Vaporizers

Vaporizing Capacities
50 GPH to 10,000 GPH

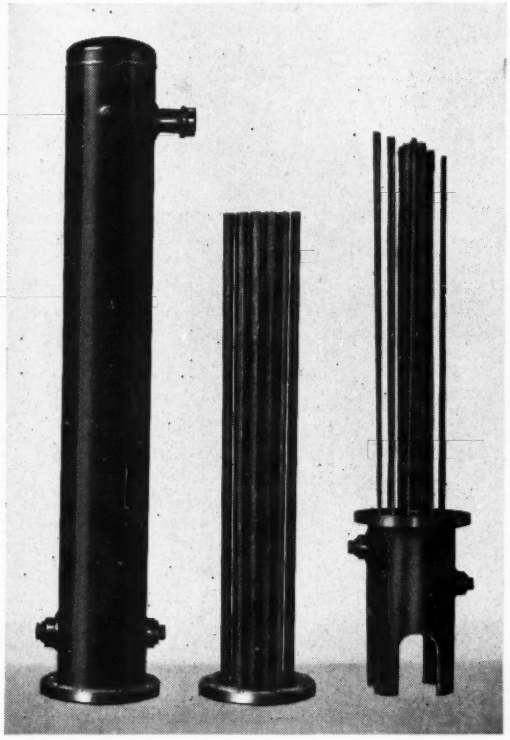

Photo above shows Armstrong Size "D" propane vaporizer dis-assembled, illustrating easy access for repair, cleaning or inspection with minimum effort.

Standardized Vertical Vaporizers available in sizes from 50 gph. to 2000 gph. vaporized per hour, propane or butane. Heating medium steam or hot water. Highly improved mechanical design.

Horizontal Reboiler Type Vaporizers available in sizes from 2000 gph. vaporized per hour, up to 10,000 gph. in propane or butane. All steel units, with removable U-tube bundles.

All Armstrong Vaporizers carry ASME Stamp, Par. U-69

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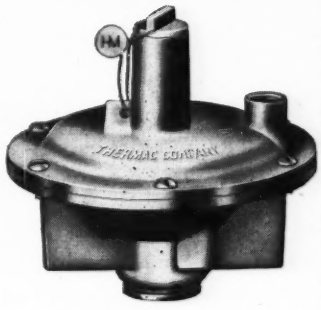
THERMAC appliance REGULATORS

Simplicity of Design—your assurance of *Dependability*



Fool-proof design in an appliance regulator means to the customer and dealer fewer service calls. We believe Thermac "TR" Series Regulator is the simplest design possible, consistent with highest performance characteristics.

Thousands of Thermac Regulators have been in operation 15 years and more without service. Insist on Thermac for best in design, for accurate pressure and flame control, for high capacity and low maintenance cost.

Sizes ⅛" to 2½" IPS.

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THERMAC COMPANY

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"20 Years Experience in Building Gas Controls"

Starting on this page, GAS presents abstracts of four technical papers first delivered at the AGA Operating Section production and chemical conference, held in New York, May 22-24.

Predicting Interchangeablity Of Fuel Gases

Louis Shnidman and Jesse S. Yeaw

A most complete and comprehensive testing program, for the study of the interchangeability characteristics of various possible substitute or test gases with respect to those of manufactured gas mixtures, which have been normally distributed over large areas of the U. S., has recently been completed by the AGA laboratories.[1] Included among the many other test results which have been made available as a result of this experimental work are certain data obtained by the use of a combustion test instrument commonly referred to as the Rochester test burner. These data together with additional data, of similar and corresponding character, obtained at the Rochester Gas & Electric Co. laboratories, furnish the basis for the subject of Part I of this paper, "Application of Rochester Test Burner to Substitute Gas Mixtures for Manufactured Gases." This is a summary of the flame characteristics of limiting interchangeable gas mixtures and their identification by means of the Rochester test burner. It is based on a review of test burner data obtained for 431 test gases of widely varying composition and heating value which have been proposed as possible substitutes for seven different manufactured adjustment gases of 535-540 Btu per cu ft.

Five critical combustion characteristics can be measured and evaluated by means of the Rochester test burner, four of them by direct test burner readings and the fifth by the proper interpretation of these readings. These include:

1. Yellow tip
2. Flame length
3. Flashback
4. Lifting or blowoff
5. Incomplete combustion on appliance burners

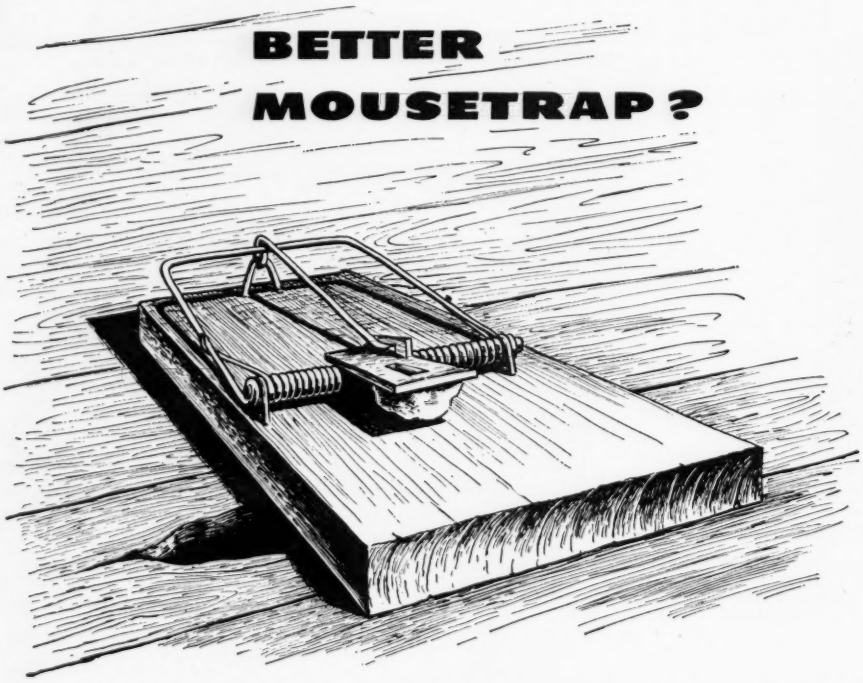
Rochester test burner readings show not only whether or not a test gas is within certain interchangeable limits, but also how near or far from the limits the test gas may be. They also reveal what particular flame characteristic is critical and thus help to show how the test gas should be modified to bring it within the required limits.

Rochester test burner data for some 60 test gas mixtures indicate that the Rochester test burner adapted with a proper sized gas orifice can be used for the measurement of combustion characteristics and the identification of limiting interchangeable gas mixtures with respect to natural gas as well as manufactured gases. These data furnish the basis for the subject of Part II of this paper, titled "Application of the Rochester Test Burner Substitute Gas Mixtures for Natural Gases."

The experimental work included in Part II has been confined to this point to test gases which have been proposed as possible substitutes for 535-540-Btu adjustment gases. These adjustment gases were composed of such gas mixtures as might be expected to be available from various manufactured gas processes. There is a capacity limitation on the test burner as it has been described and used for the experimental tests so far described in this paper which limited its practical usefulness to gas mixtures ranging in heating value from about 400 to 900 Btu per cu ft. It is possible, however, to alter the capacity range of the test burner by changing the burner orifice. The interpretation of the test burner data previously given

[1] "Interchangeability of Other Fuel Gases with Coke Oven Gas" and the other associated AGA Research Reports Nos. 1106A, B, C and D, dated Oct. 1948. Dec. 1948, Jan. 1949 and April 1949 respectively, submitted for the AGA Project TL-1 on Mixed Gas Research.

Mr. Shnidman, laboratory director, and Mr. Yeaw, chemist, are both with Rochester (N.Y.) Gas & Electric Co.



The story of the reward for a better mousetrap is proverbial. But the fact remains that most mice are still caught by this simple, economical and effective contraption.

Gas purification is a parallel case.

Iron Sponge, preferred for the removal of H_2S seventy-five years ago, is still preferred today. And for these same reasons . . . simplicity, economy and effectiveness.

Iron Sponge operates with high efficiency at high or low pressures, has excellent capacity and activity, gives long service between foulings and is simply and quickly regenerated.

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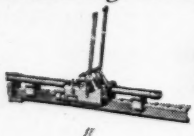
ON UNDERGROUND
PIPING JOBS

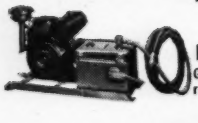
...with a GREENLEE PIPE PUSHER

Installing pipe underground is quick and simple this way. With a GREENLEE Hydraulic Pipe Pusher *one man* pushes pipe through the ground—under streets, railways, walks, lawns, floors. Saves time, cuts costs through elimination of extensive ditching as just a short trench accommodates the Pusher. No tearing up of pavement, lawns, floors... eliminates tunneling, back-filling, tamping, repaving. Cuts job time to a fraction. Pusher often pays for itself through timesavings on first job or two.



No. 790 GREENLEE PUSHER For 3/4 to 4-inch pipe. Six speeds—5,600 to 40,000 lbs. pushing pressure.

No. 795 GREENLEE PUSHER For pipe larger than 4-inch, concrete sewer pipe, large drainage ducts. Six speeds—25,000 to 150,000 lbs. pushing pressure.



POWER PUMP For both sizes of GREENLEE Pushers. Pushes pipe at rate of two feet per minute.

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GREENLEE

Get facts on timesaving Greenlee tools now. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 1950 Columbia Avenue, Rockford, Illinois, U. S. A.

in this paper would not apply if such an alteration were made, but there is reason to believe that, with sufficient data at hand, a new calibration could be derived, and that the Rochester test burner could be employed in the identification of limiting gas mixtures with respect to other adjustment gases of different composition and heating values.

Organic Sulfur In Synthesis Gases

By A. E. Sands, H. W. Wainwright, and G. C. Egleson

1. No thiophene has been found in synthesis gas made from pulverized coal, steam, and oxygen in the U. S. Bureau of Mines pilot plants.

2. Addition of 0.038 lb of hydrated lime per lb of coal lowered the organic sulfur content of the gas but had no effect on hydrogen sulfide content; doubling this ratio of lime to coal further reduced the concentration of organic sulfur, and reduced the concentration of hydrogen sulfide in the gas.

3. The relation between sulfur content of coal and organic sulfur concentration in the gas cannot be simply stated. This relationship varies with the rank of the coal, steam to coal ratio, and other operating conditions. Typical concentrations of organic sulfur in the gas for different operating conditions range from 5.1 to 50.6 grains/100 scf.

4. Other conditions remaining unchanged, increasing the steam to coal ratio greatly decreases the organic sulfur concentration in the gas.

5. Different combustion methods for determination of total (organic) sulfur are presented. Of these, the IGT method, with modifications made by the Bureau's laboratory, appears to be the best.

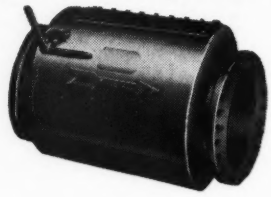
6. A limited amount of work on the modification of the Referees method for determination of total (organic) sulfur shows that the method, as modified, can give excellent results.

7. A procedure for the use of the Betz-Hellige turbidimeter for determination of barium sulfate resulting from combustion methods of determining total (organic) sulfur is presented. This procedure, as revised by the Bureau's laboratory, is capable of determining as little as 0.0001 grain of sulfur (as barium sulfate) per 250 ml of solution.

8. A procedure for the turbidimetric determination of barium sulfate, using the Beckman spectrophotometer is outlined. As little as 0.001 grain of sulfur (as barium sulfate) per 250 ml of solution can be determined. While this method has only one tenth the sensitivity of the Betz-Hellige method, concentration of solutions by evaporation can overcome this objection. Elimination of the necessity of judging light intensity end-points is the great advantage of this method.

9. Other methods for determination of small amounts of sulfate were investigated, but found to have no advantages compared with turbidimetric methods.

Mr. Sands is assistant chief, synthesis gas production branch, Office of Synthetic Liquid Fuels, U. S. Bureau of Mines, Morgantown, W. Va. Mr. Wainwright and Mr. Egleson are chemical engineers in the same branch.



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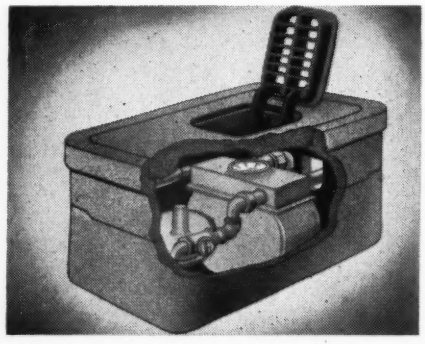

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10. Difficulties were experienced in obtaining satisfactory results from a method for organic sulfur determination which depends on conversion of organic sulfur to hydrogen sulfide over activated alumina. While the difficulties can undoubtedly be eliminated, further investigation of the method was dropped because of the advantages of the platinum spiral method.

11. The analytical method of Lusby, involving conversion of organic sulfur to hydrogen sulfide, utilizing the hydrogen content of the gas and a hot platinum spiral as catalyst was studied and further developed. This method has been adopted by the Bureau's laboratory because of its sensitivity, accuracy, and speed.

12. A method for catalytic conversion of organic sulfur in the presence of large amounts of hydrogen sulfide was studied as a process for purification. Due to an equilibrium between hydrogen sulfide, carbon monoxide, and organic sulfur (presumably carbonyl sulfide), the method cannot be used in its present form for the complete elimination of organic sulfur from synthesis gas. The method probably has considerable merit for certain applications where about 2 grains of organic sulfur can be tolerated in the purified gas.

13. Brief studies of the use of cobalt-molybdate and of platinum on activated alumina for use as catalysts in organic sulfur elimination did not give satisfactory results.

14. Experiments with catalysts which simultaneously remove organic sulfur and hydrogen sulfide (Huff catalysts) gave excellent results. Purification can be effected to leave less than 0.1 grain of total sulfur per hundred cubic feet of purified gas. Further work on this method is in progress.

15. A limited amount of investigation of alkalized iron catalyst for the oxidation and removal of organic sulfur, as used in German synthetic fuel plants, proved that the catalyst produced by an American manufacturer can be used for purification of synthesis gas to below 0.1 grain of total sulfur per hundred cubic feet. The method is believed to be more expensive than some other possible methods. Further work is in progress.

16. Several activated carbon samples were evaluated for their ability to remove thiophene at atmospheric pressure. In most cases, the carbons adsorbed 4-5% of their weights in sulfur (as thiophene). Data are presented.

17. The removal of carbonyl sulfide at 300 psig by activated carbon was studied. Capacities of carbons were lowered by carbon dioxide in the gas. Data on the effect of linear velocity, carbonyl sulfide concentration, and carbon dioxide concentration on capacity are presented.

Appraising Reserves Of Coking Coal

By Ralph L. Brown

THE Bureau of Mines program on the appraisal of coking-coal reserves has three objectives. These are: first, an inventory of proved minable coking coal reserves; second, the basic washing characteristics of these coals; and third, their basic coking characteristics.

This investigation and its results should

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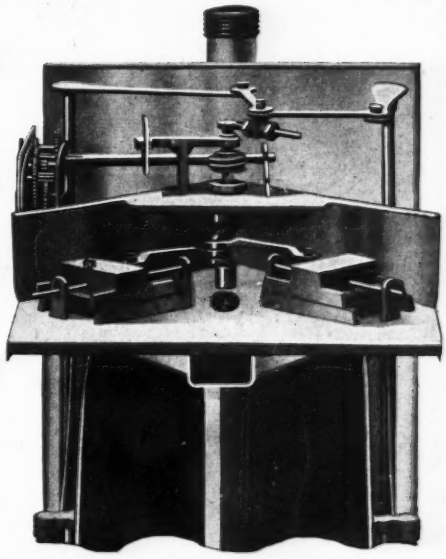

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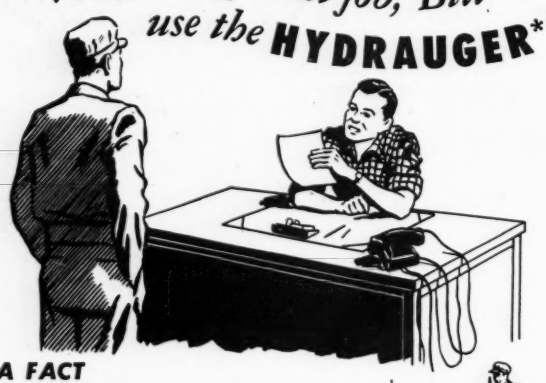

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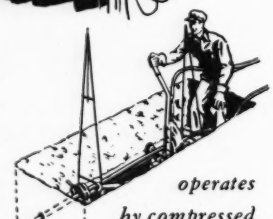

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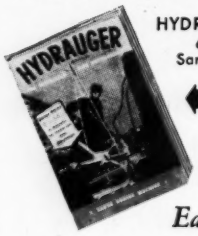

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be, and undoubtedly are, of definite interest, certainly for the long term to the gas industry, those working in it, and those responsible for future gas supplies.

The present day prairie-fire type of expansion in natural gas pipelines and natural gas use over the country is setting the stage for a great high-Btu-gas-from-coal industry for which the country is not technologically prepared. For natural gas use, facilities are being installed and/or adjusted to high-Btu gas (1000) the country over. People are being educated to its use and convenience in house heating. Loads are being built up generally, and urban distribution systems (by reason of high peripheral or suburban loads) are being rendered inadequate for a return to low-Btu gas (500), particularly in times of national emergency, of supply interruption, or of inadequate supply for any of many reasons. Responsible thinking can only see generally rising prices for natural gas in the field and at the consumer level; and, sooner or later, difficulties and then decline in supply. This could be soon in an emergency.

We dare not wait for the natural gas supply to decline to seek the substitute—high-Btu gas from coal. It will take five to 10 years to do the research and development work.

Responsible opinion is increasing that low-Btu gas—manufactured gas of 500-550 Btu—is virtually obsolete; and, by the same token, much of the present-day equipment, as it now stands, is either obsolete, will be scrapped, or will be converted to peak-load use with oil gas (a highly costly gas).

The situation calls technologically for the development of basic data on essentially three major items, namely (a) the conversion of coal to water gas, (b) the conversion of water gas to high-Btu gas—a catalytic methanization step, and (c) authoritative gas-production cost data for these processes, based on operation of pilot plants of the better methods studied or developed.

Mr. Brown is chief, Coal Branch, Bureau of Mines, U.S. Department of the Interior, Washington, D. C.

The Morgantown Fluidized Feeder

By J. H. Holden and C. W. Albright

A feeder has been developed by the U. S. Bureau of Mines at Morgantown, W. Va., in cooperation with West Virginia University, to feed coal at a uniform rate to a pulverized-coal gasifier making synthesis gas. Tests on the feeder have shown that the standard deviation from the average per second rate of coal flow is 1%. Experience with the feeder in operation has demonstrated that the average hourly rate of coal flow also deviates on an average of about 1%.

The materials that have been fed successfully include 90% through 200-mesh coal, 100% through 10-mesh coal, sand and pulverized limestone. The feeder should be applicable to any solid that can be fluidized.

The volumetric percentage of solid in the mixture of solid and gas flowing through the delivery tube of the feeder is about 20% and is essentially independent of pressure, at least between 1 and 10 atmospheres.

Mr. Holden and Mr. Albright are chemical engineers, synthesis gas production branch, U. S. Bureau of Mines, Morgantown, W. Va.

CURRENT READING

The following two papers have been preprinted from the American Society of Heating & Ventilating Engineers Journal Section, Heating, Piping & Air Conditioning. Brief summaries are presented here.

EFFECT OF TEMPERATURE ON BALANCE of Forced Warm-Air Systems — by N. A. Buckley, S. Konzo, J. M. David, and T. L. Towne.

A forced warm-air heating system which maintains desired indoor temperatures in all occupied spaces, and under all load conditions, is considered to be in balance. Normally any unbalance which occurs in a system can be traced directly to unusual weather conditions such as high velocity winds, or intense solar radiation. However, some cases have been reported in which the unbalance that was observed could not be attributed to unusual weather conditions alone.

Up to this time no satisfactory explanation has been offered for this phenomenon although the evidence indicates that the unbalance was in some ways related to the total volume of air flowing in the system and the relative elevations of the supply registers. In some extreme cases it has been observed that a warm-air register located in the basement may become sufficiently unbalanced so that under mild weather conditions the supply of warm air is reduced to a negligible quantity. In view of the widely varying explanations as to the cause and extent of this unbalance, a series of laboratory tests under controlled conditions was conducted.

Unbalance in a forced warm-air system was studied by testing in the laboratory and by an analytical method. When unheated air was circulated in a system, a change in total air quantity resulted in a proportionate change in delivery of each branch. A system which was in balance with large total quantities of heated air tended to become unbalanced when the total quantity became relatively small. The unbalancing action was attributed to stack effect. Close agreement was obtained between test and predicted values.

TRANSIENT HEAT FLOW APPARATUS for the Determination of Thermal Conductivities—by F. C. Hooper and F. R. Lepper.

A portable instrument consisting of an electrically heated probe has been developed and used at the University of Toronto for determining within 10 minutes the thermal conductivity of wet or dry solids. Specimens such as soils can be tested without disturbing their natural condition. Moisture conditions of material do not change during test because duration is short.

Usefulness of the instrument is demonstrated and the precision of measurement indicated.

BLACK BONANZA—by Frank J. Taylor and Earl M. Welty, published by McGraw-Hill. This is a historical narrative of oil in the West, as revealed in a study of the Union Oil Co. of California. It contains 272 pages, 196 illustrations. Price: $4.

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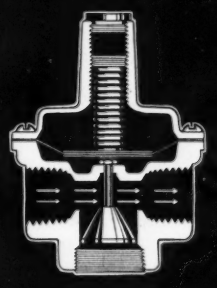

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PLANNING CORROSION CONTROL PROGRAM: III

Selecting Cathodic Protection Instruments

By CARL R. DAVIS
The Montana Power Co., Butte

CORROSION engineers need good instruments. In planning a corrosion program, plan also to secure an adequate supply of suitable corrosion instruments.

If you have instruments on hand left over from electrolysis surveys and testing, they may be useful, but in general, new set of instruments for each corrosion engineer will be essential.

The modern instruments generally used in galvanic corrosion and cathodic protection testing are much more sensitive and delicate and more costly.

More rugged lower cost instruments will be suitable for the junior corrosion engineers and operating personnel who will make periodic tests in connection with operation and maintenance of the cathodic protection installations.

Don't purchase your corrosion instruments until your corrosion program is planned and you start organizing the work and your corrosion department, so that the instruments when obtained will be of the types suitable for your engineers, and corrosion and cathodic protection testing methods to be used.

Naturally, methods used and recommended by different corrosion engineers and corrosion consultants vary, and some methods require special or different types of instruments.

However, when you do purchase your instruments, don't try to economize, but secure whatever is necessary to carry on the work. Don't handicap your corrosion engineers by lack of suitable instruments.

As a rough estimate, a complete set of desirable instruments for each corrosion engineer will cost between $1500 and $2000.

The instrumentation subcommittee of the AGA corrosion committee is preparing a reference book on corrosion and cathodic protection instruments and associated test equipment. It will include a text and manufacturers data on ammeters, voltmeters, potentiometers, soil-resistivity instruments, pipe locators, coating holiday detectors. This reference book on instruments probably will be ready in about six months.

Meanwhile, if the members of the instrumentation subcommittee can be of assistance to any of you, they will be pleased to do so.

With a corrosion control program planned, corrosion costs analyzed, corrosion engineers selected and instruments available, the corrosion program can be put to work.

How to Put a Control Program to Work

By P. H. Miller

Texas Eastern Transmission Corp.
Shreveport

YOUR company is indeed fortunate if you are already staffed for effective corrosion control or at least have definitely assigned to some competent individual the responsibility of putting a corrosion control program in motion. If you are interested in making your program 100% effective, you must first look into your policies and procedures for the *dissemination of information between departments.*

Every physical change, alteration, addition, or connection to the pipelines and other metallic facilities of the company should be scrutinized closely for possible effect on the corrosion control program. Therefore, a definite routine should be set up whereby the man in charge of your corrosion program is furnished copies of all letters, agreements, contracts, maps, drawings, etc., having to do with such matters. Also, the local corrosion engineers in the field should be notified as a routine matter concerning all leaks or pits in pipe which are encountered by crews not accompanied by a member of the corrosion department.

The local corrosion control man should be notified when pipe and other structures are to be excavated so that he can make an inspection and record the condition of coating and pipe for corrosion records. On the other hand, it is imperative that your corrosion department *keep the department on whose facilities tests are being conducted or cathodic protection installations are being applied fully informed* concerning the con-

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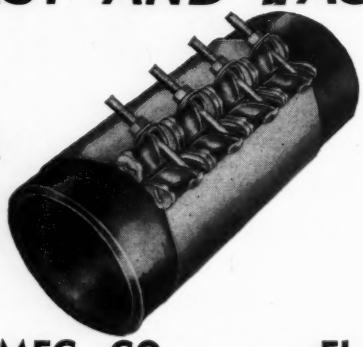

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ditions necessitating the installations, the extent of protection to be obtained, and the physical aspects of the projects. The entire corrosion control staff should realize that *full cooperation must be maintained between the activities of themselves and others* within the organization.

Since electrical methods of corrosion control are of a highly specialized and technical nature, management personnel cannot be expected to be fully acquainted with the technical details involved. It should suffice for them to know that properly applied electrical corrosion control methods are the answer to the underground corrosion problem; hence, they should have no hesitancy in *approving corrosion control appropriations based on the studies of those directly responsible for the corrosion control program.*

At least one member of your corrosion control staff must be conversant with electricity both from a technical and practical viewpoint. Small organizations may find it more economical to make use of the complete corrosion control services offered by consultants. Larger companies should take advantage of the saving to be derived from the employment of men who are and others who can be trained to carry out a complete corrosion control program within their own organization. In all cases, the corrosion control staff should have authority to engage independent consultants when additional help is required to expedite critical jobs.

Since experienced corrosion engineers are not widely available, the best approach toward the institution of a competent corrosion control program might begin with the employment of one or two men who are qualified as corrosion engineers. Such engineer or engineers could be used as the nucleus of an independent corrosion department, or they could be attached to an existing technical service department such as measurement, communication, or electrical, whichever already has engineers with cars equipped for instrumentation work in all of the areas to be covered by the corrosion control program. In cases where the corrosion control duties are to be handled by an existing technical service department, it would be the duty of the experienced corrosion engineers to train the instrument engineers in corrosion control work. In order for such a program to be most effective, the corrosion engineers must be given the full confidence of the department superintendent, the division managers, plant managers, and other employees in the areas in which they are to function. The superintendent in charge of your overall corrosion control program should have considerable voice regarding any personnel to be employed for participation in corrosion control activities as well as training methods to be used.

In selecting trainees for participation in corrosion control activities, particular consideration should be given to background in the way of education, experience and dependability. Since the study of electrical theory and practice does not appeal to too many men faced with the problem of self-education and since the knowledge derived from such study is absolutely necessary before a man can be trained as a competent corrosion engineer, all other qualities being equal, it is reasonable to believe that you get more for your company's money by employing college-trained engineers for trainees.

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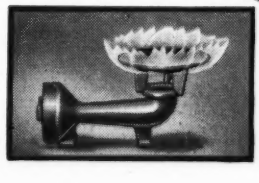

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experience are required before an engineer can be properly trained, trainees should be allowed to devote their entire time to corrosion work for the first several months. However, after a man has mastered the basic principles of corrosion control, there is no reason why he cannot be relied upon to handle other instrumentation work and related technical duties in his assigned area, so long as he is not overloaded to the extent that his corrosion program must be slighted. Some smaller companies have found it successful to have a trained corrosion engineer with a helper start at one end of the system with the necessary equipment and move from one area to the next doing the work themselves, using local help of the district in which the work is being done. On a large system, however, with this method one end or parts of the system might suffer serious damage before the engineer can arrive on scene to get the corrosion under control. Also, such a procedure will not produce a well-trained organization in a minimum of time.

Research and skilled design, both from a technical and economic standpoint, can quite easily prove fruitless unless a well-planned system is employed whereby all the steps from the initial survey to the actual completion of corrosion control installations follow in efficient succession.

Generally speaking, the district or plant corrosion control staff will make the initial survey after locating an area requiring cathodic protection. This will include a *study of foreign lines in the area* for possible interference problems, *availability of power* where rectifiers are to be used, and *determination of most suitable soil* if ground anodes are to be installed.

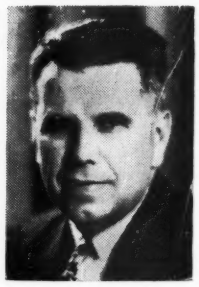
Consideration for the tenant when entering or crossing other people's property should always be practiced as initial diplomacy will result in priceless goodwill.

After the local corrosion control staff has completed the initial survey and determined first and second choice locations, if possible, for each recommended corrosion control unit, the data sheets are forwarded to the supervisor of the corrosion control program. Then, the corrosion engineer and a member of the local corrosion control staff will visit the area together, weigh the merits of various locations, determine current requirements, consult power companies serving the area and consult foreign operators that might be affected.

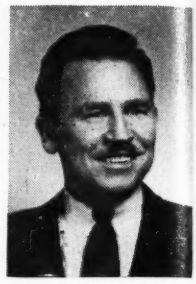
If past experience has not dictated the peculiarities of the system relative to current requirements, tests may be required to determine this factor. Small test sites energized with storage batteries may be employed to determine current requirements. Continued experience and familiarity with a system may eventually provide an engineer with sufficient factors to appreciably decrease the necessity for this procedure. Cathode resistances and soil resistances may be determined by the use of a megger, and anode resistances can be computed by various methods, such as Dwight's curves.

Conclusions having been arrived at, the *preparation of a proposal* follows, which will include plot plans and sketches of the proposed installations, along with material specifications and other requirements. The proposal, besides outlining the construction for the actual cathodic protection units, will provide for testing facilities throughout the area to be protected and provisions for any necessary bonds with foreign structures.

After the proposal has been approved, if any part of the installation is to be on other people's property, a *corrosion engineer, completely familiar with the program, will accompany a right-of-way agent* to purchase the necessary rights-of-way. A complete drawing of the installation will be shown to the tenant at the time the right of way agreement is drawn up so as to eliminate any misunderstandings at the time of construction. Requisitions for the purchase of all material will be made by corrosion control personnel and presented to the proper office for processing. The complete preparation by the corrosion control staff eliminates possible substitutions or misunderstandings, which very often cause serious delays. The corrosion engineer in the field will keep abreast of the receipt of material in order to lend his assistance when necessary.



Carl R. Davis



Pat H. Miller

As soon as necessary material is available, any test leads which are indicated should be installed while waiting for the balance of the material to arrive. Such prior installation of test leads will provide an original set of potential readings completely free of polarization effects which might be present on coated installations when a cathodic protection unit is intermittently operated for making such readings.

A corrosion engineer should definitely be present throughout the actual construction of any corrosion control unit. This will prevent any detrimental short-cuts in construction, or faulty construction.

When the cathodic protection unit is installed and the initial current is impressed or drained, an *immediate survey should follow* to determine adequate protective limits and possibilities of interference with foreign structures. Test leads previously installed at foreign crossings will be employed for determining interference to structures and if necessary a resistance bond will be installed to draw stray current from the foreign structure back to the protected system. Once the extent of the protected area has been determined, the maintenance of a corrosion control project is routine. Rectifiers will be checked at least once each month to insure continuous operation and readings at test leads need be checked only once or twice a year.

If galvanic anodes are employed, right-of-way problems may be less critical than where rectifiers are used, since these anodes can generally be installed on the immediate pipeline right-of-way and if necessary nothing need be left above ground. However, the use of a marker and test leads to indicate a galvanic anode installation greatly facilitates future checking.

While material is being received for a previous work order, or a proposal is waiting for approval, the next project will be surveyed and recommendations prepared. In this way there will be no interruptions in a corrosion control program and all concerned will be more prone to lend cooperation if we present evidence of an active program rather than a passive or intermittent one. All the research and testing in the world won't do any good unless it is vigorously followed up by actual installations.

(To be continued.)

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How Stan-Pac Spot-Reconditioned Its Gas Pipeline 'In Place'

By W. JOHNSON

TABLE 1

Pipe Size	Wall Thickness	No. Sections	Range From	Range To	Total Reconditioned
20 in.	9/32 in.	10	200 ft	2000 ft	9,923 ft
22 in.	5/16 in.	6	500 ft	6500 ft	13,049 ft
26 in.	5/16 in.	14	150 ft	5100 ft	28,744 ft
Total		30			51,716 ft

TABLE 2

Excavation, backfill, and clean up	60 man days/month
Line cleaning	45 " " "
Reconditioning (inspection, welding, etc.)	100 " " "
Prime and wrap	70 " " "
Total manpower for the program	275 man days/month
Other necessary operation and maintenance work in the area	70 " " "
Total manpower requirements for each recondition program and other requirements	345 " " "

STANDARD Pacific Gas Line Inc. recently completed a program of spot reconditioning on its pipeline system between the Tracy and San Pablo stations, in California, a pipeline distance of nearly 56 miles. This program extended over a two-year period starting in the early part of 1948 and terminating in the latter part of 1949. The actual working time amounted to a total of 14 months, or the 7-month period between May and December each year. The important feature of this program was that the reconditioning work was performed on the pipeline in place, while in service.

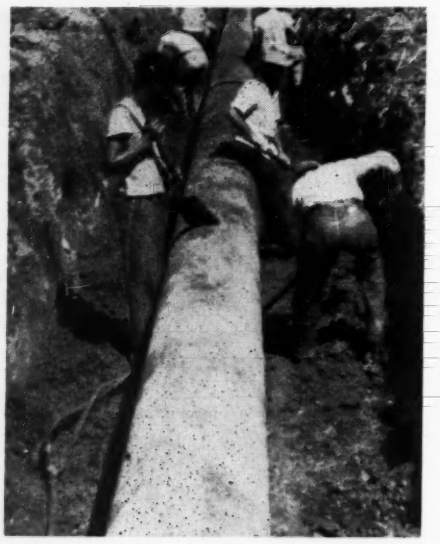
The program was based on the leak frequency, type of soil (determined from a previous test hole or leak report), and the location of the section with respect to drainage. From this information a reconditioning program was developed as to the number of sections and the footage of pipe in each section. This information was reviewed by the Standard Oil Co. electrolysis engineers, who in turn made an electrolysis survey of the section of line between Tracy and San Pablo. They used the Megger method and the results of their findings were in agreement as to the number of sections; however, the footage was changed in each of the sections to conform with the electrolysis survey. This spot reconditioning program was spread over 56 miles of pipeline and involved 30 sections, with the sections ranging from 150 ft to nearly 6500 ft. *Table 1* shows the number of sections of each size of pipe.

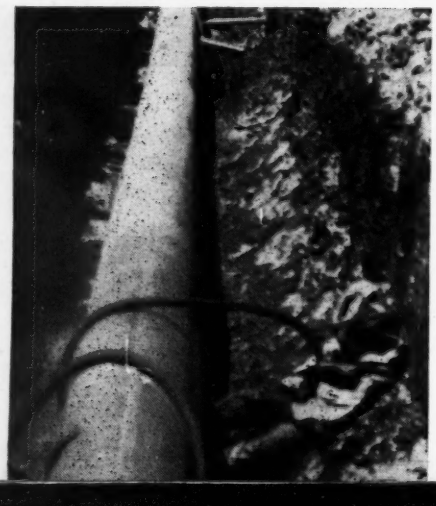
As a general rule, projects of this size were not attempted by the maintenance crews of the company, but were turned over to pipeline contractors on a cost plus basis.

This being the first project to be performed by the company, the cost of the project was estimated very carefully and the reconditioning crews were built

Mr. Johnson is a member of the operating department, Standard Pacific Gas Line Inc., San Francisco. His paper was presented to the Pacific Coast Gas Assn. transmission conference, Santa Maria, Calif.

ABOVE: Tractor on special utility, tilt-bed trailer. LEFT: Trench hoe, ½ c.y., mounted.





TOP: Hoe excavation to 18 in. below pipeline.

SECOND: Removing bearing under pipeline.

THIRD: Placing blocking under pipeline.

BOTTOM: Sandblasting pipe.

around the experienced personnel in the maintenance crews on the system.

The additional help required was hired on a casual basis as pipeline helpers, unless the applicants' previous experience justified a better rating, which happened on one or two occasions.

The advantage to the company in utilizing the regular personnel simply meant that it had employees experienced in all phases of the work that could be shifted from one type of work to another and not interfere with the progress of the work. It also meant that the casual help would be working with the experienced company employees. This arrangement contributed largely toward the excellent safety record attained on this project.

The personnel requirements for the program were based on 100 ft per day of completed pipe, or 2200 ft per month for each crew on a five-day-per-week basis. The personnel requirements of each crew for this program were as shown in *Table 2.*

Based on the foregoing requirements, each reconditioning crew would consist of the classified personnel on a five-day, 40-hr week basis as shown in *Table 3.*

Considerable difficulty was encountered in obtaining desirable help in the Contra Costa county area and consequently the crew was short of the 16 men planned. The total crew averaged 12 men over the two-year period, in the Concord area. In the Tracy area no difficulty was encountered in obtaining a full crew; however, the turnover was higher than expected.

The reconditioning program fell short of the 4400 ft per month anticipated for both crews. Instead, an average of approximately 3600 ft per month was obtained, which was about 15% less than estimated.

Table 4 shows the additional equipment required.

Equipment Requirements

It was apparent that the equipment on hand was not adequate to undertake a project of this size. It was therefore necessary to purchase the special equipment required to perform the work.

The model 20 caterpillar tractors were on hand and proved very useful in towing the 210 compressor and trailer, on which the sandblast units and sand was carried to keep pace with the work.

Each crew was equipped with a home made sand dryer, which consisted of an

Table 3

Classification	Number	Man days/ Month
Foreman	1	22
Trench hoe operator	1	22
Mechanic welder	2	44
Line mechanic	1	22
Line repairman	3	66
Line helpers	8	176
Total	16	352

TABLE 4

Type of Unit	Required	Equipment On Hand	Equipment to be —Purchased— No.	Cost	Use
Trench hoe, ½ yard, truck mounted	2	0	2	$30,092.37	Excavation work
Air comp 210 cu ft.	2	0	2	9558.08	Cleaning pipe
Air comp 105 cu ft.	2	2	0		Misc. work
Welding machines	4	2	2	1501.93	Repairing pipe
Tractors D 4	2	2	0		Daylight backfill
Tractors model 20	2	2	0		Towing equipment
Melting kettles, 115 gal.	4	1	3	983.63	Wrapping pipe
Acetylene units (comp)	4	2	2	250.00	Cutting patches, etc.
Pneumatic Tools					
Chipping guns	2	0	2	144.00	Cleaning pipe
Scaling tool	2	0	2	92.00	" "
Clay spades	4	2	2	310.00	Excavation work
Tampers	2	0	2	264.00	Backfill
Paint guns	4	2	2	146.62	Priming, etc.
Total cost				$43,342.63	

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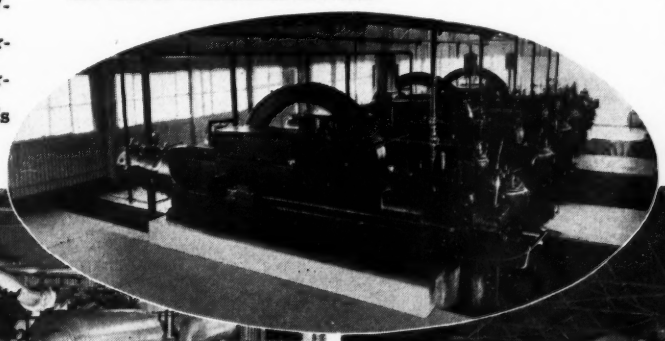

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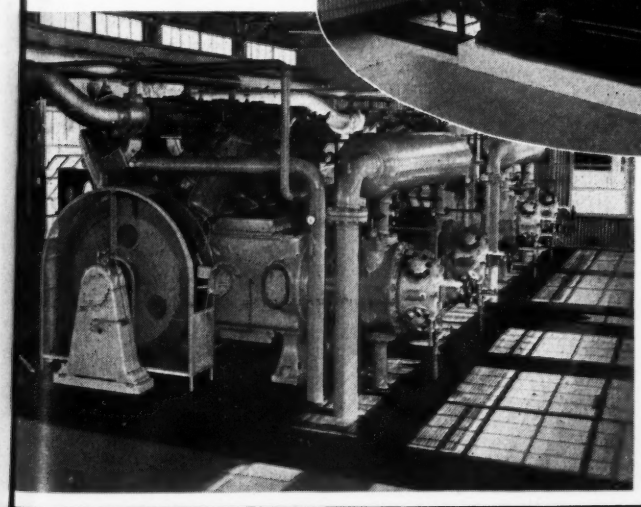
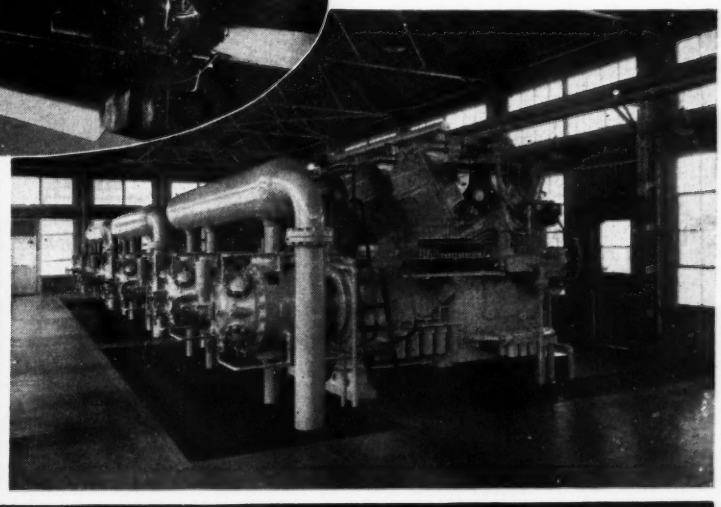


Line-up of three Cooper-Bessemer GMV-8 Turboflow compressors, 880 hp each added last year to Lone Star's Fox Station.



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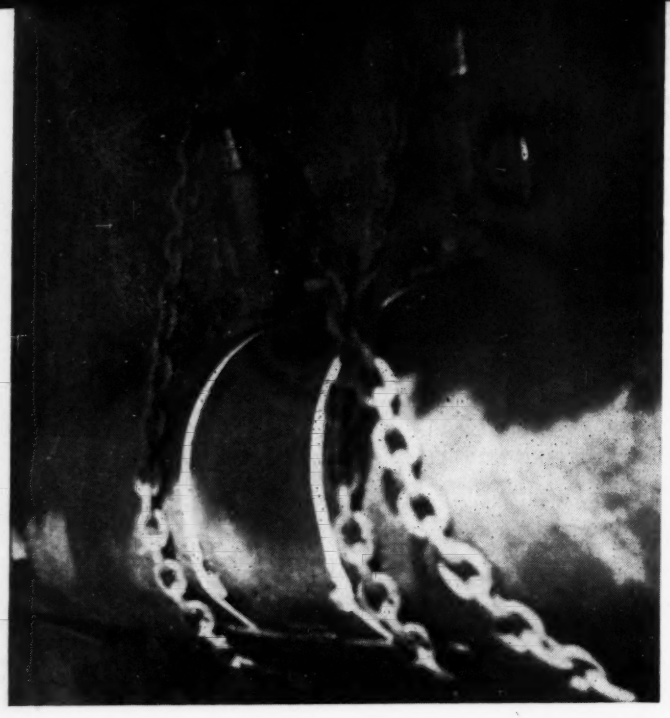


LEFT: Patch plate ready for welding; chains and jacks in place.

RIGHT: Application of patches and one-third circle pipe.

inverted conical shaped sand receiver fitted around a heating element using two gas burners. The sand for sandblasting was Monterey sand, No. 4 Lapis, which was usually obtained wet, however the sand dryers were able to keep abreast of sand use.

Excavation

The excavation work was performed by the trench hoes. The hoe excavated on each side of the pipe the width of the hoe bucket (30 in.) and to a depth 18 in. below the bottom of the pipe. The bearing under the pipe was removed with clay spades and spread over the bottom of the ditch to eliminate hand excavation; this left from 12 to 14 in. in the clear under the pipe. Upon the removal of the bearing under the pipe, blocking was placed at 50-ft intervals.

To assist the excavation in hard ground, each hoe bucket was provided with a removable partition for the use of ballast. The hoe bucket was fitted to permit installing the partition in two positions, one of which allowed the use of 400 lbs of ballast and the other 800 lbs of ballast. Iron punchings was used for ballast material. About one hour was required to either install or remove the ballast.

The type of soil structure ranged from sandstone to sandy loam and the pipe excavated ranged from 50 ft to 250 ft per day, respectively. About 250-ft section of pipe was exposed and a 25-ft block of ground was left between each 250-ft section. Each end of the 250-ft section and midway between the ends, a ramp was excavated for access to and from the excavation. The 250-ft sections excavated eliminated the need for side blocking, permitted concentrating the personnel for better supervision and safer working conditions.

The width of the excavation averaged 8 ft and the depth averaged 7 ft. For each lineal foot of pipe exposed, approximately 52 cu ft or 1.9 cu yds of earth was excavated. The entire reconditioning program required the trench hoes to excavate approximately 98,000 cu yds of earth, with only minor repairs to the hoes necessary.

During the course of the excavation work the pipeline was punctured on two occasions with a hoe bucket tooth; repairs were made without a shut down. The excavation work was performed without an injury to the personnel engaged in this phase of the work.

INSTALLATION of patches is shown below.

Cleaning

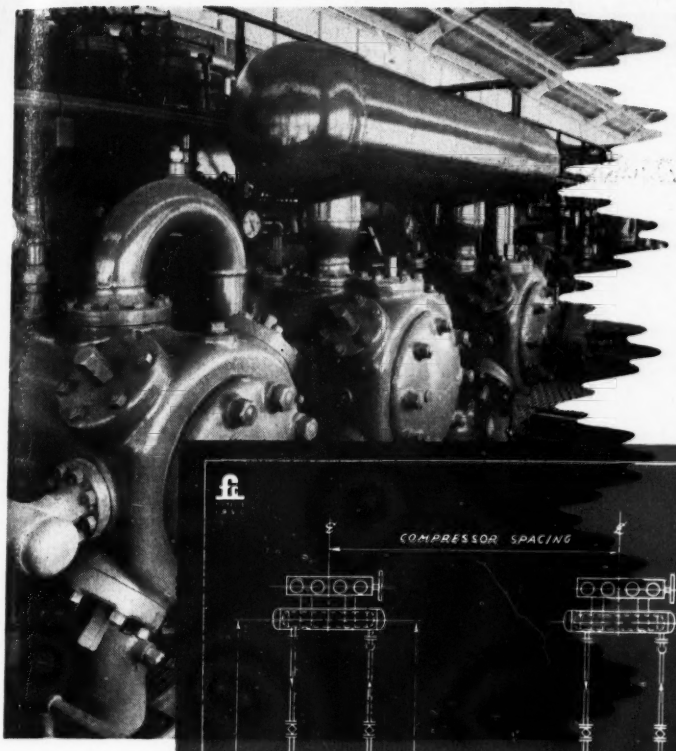
The pipe was given a light cleaning with shovels shaped to the contour of the pipe and used as scrapers. This was followed by sandblasting and the pipe was cleaned of all scale. Corrosion pits were sandblasted until the metal appeared bright, in order to improve and speed up spot welding.

Two sandblast units were used by each crew. The operators were furnished with pressure type sandblast hoods which provided filtered air to the operator and prevented dust from entering the hood. The sandblast units were 5.3 cu ft capacity and the two units were operated by one 210 cu ft compressor with about 80 psi nozzle pressure. The sandblast nozzles were cast iron with a 3/16-in. orifice. The nozzles gave slightly over two hours use before the orifice was enlarged to the extent that its efficiency was impaired.

With two units in operation, the pipe cleaned ranged from 150 ft to slightly over 200 ft per day. An average of 16 lbs of sand was required per lineal foot of pipe. A total of approximately 420.5 tons of sand was required for the entire program.

Repairing

Upon completion of the cleaning, each 250-ft section of pipe was inspected to determine the extent of repairs. The procedure followed required that all individual pits that penetrated half the thickness of the pipe or more were to be



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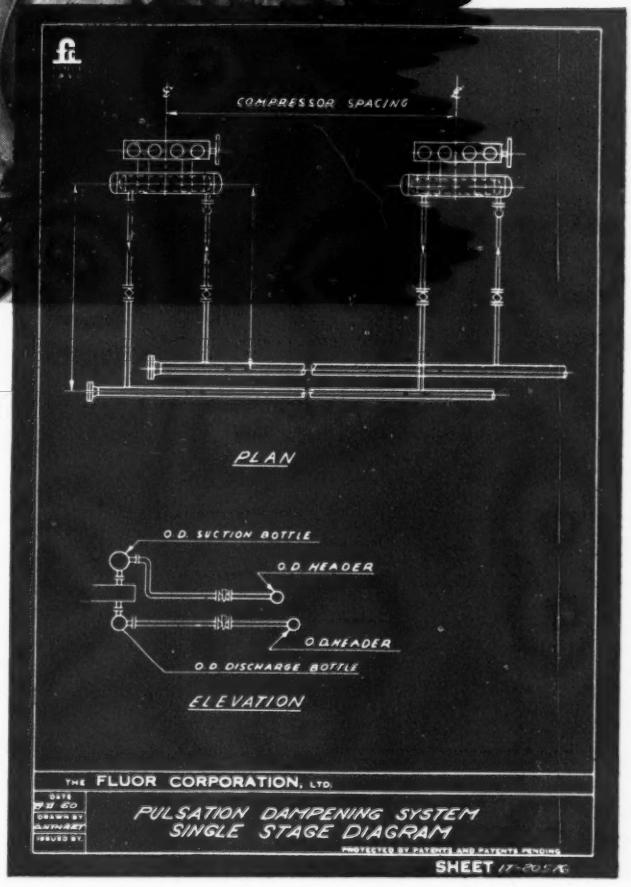

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BOX-STRAPPING machine with pressure applied on rubber plugs.

spot welded. In the case of chain pitting, that is: connected pits either a patch plate or sections of 1/3 or 1/2 circle pipe were placed over the pitted area and welded in place. The chain pitting generally occurred in large areas and usually on the bottom of the pipe. It was difficult to determine the depth of the pitting because corrosion had obliterated the original pipe wall. At a number of locations it was necessary to butt together several 10-ft sections of 1/3 or 1/2 circle pipe to cover the badly corroded areas.

The point of maximum pressure, with respect to the various sections of reconditioning, occurred at Tracy decreasing toward San Pablo. Adjacent to Tracy station the pressure ranged from 350 to 400 psi; at Los Medanos 275 to 330 psi and at San Pablo, 110 to 200 psi.

With the exception of a few sections near the Tracy end, the patching material was welded to the line using a minimum of three passes and was not banded around the pipe. The 1/3 and 1/2 circle pipe was installed in the same manner, except for a few locations near Tracy. At these locations banding patches or complete encasement of the pipe was deemed necessary, because of pipe condition and the higher operating pressures.

The leaks encountered were repaired with a box strapping machine, using neoprene rubber plugs over the leaks. This method of shutting off gas line leaks has been in use on this system for over two years and the strapping machine is recommended for this work because:

1) Leaks can be shut off in a fraction of the time required by other methods.
2) Any number of leaks can be shut off at a given location and not interfere with permanent repairs (installation of 1/3 or 1/2 circle pipe) because of the thin steel strap used .035-in. thick and ¾-in. wide.
3) Permits thorough inspection of the pipe on each side of the leak under safe conditions, that is, free of escaping gas so that size of patch to cover the affected area can be determined. This is extremely important because in a good many cases temporary repairs with a band clamp or patch plate method did not cover the badly corroded area and consequently the patch could not be welded because of the hazard involved. This often required removing the patch already in place, to install a larger patch, which meant shutting off the leak a second time.

At several locations in this reconditioning program, as many as seven leaks were shut off in approximately 10 ft of pipe. A total of 185 leaks was shut off with the box strapping machine on this project, some of which were already present, others resulted when corrosion pits were sandblasted. These leaks ranged from ⅛ in. to ¾ in. in diameter and were shut under pressure ranging from 175 to 350 psi. The ¾-in. diameter leak was shut off under 225 psi, however three straps were used, one over the other. The second and third straps could be pulled up tighter because of less friction due to the smooth surface of the preceding strap.

The half and third circle pipe is, as the name implies, either two or three pieces respectively, required to completely encase the pipe. The half and third circle pipe used on this program was rolled from 5/16-in. plate in 10-ft lengths to the outside diameter of the pipe that it was used on. For example, 20-in. ½ circle pipe would be 20-in. ID ½ circle pipe, 5/16-in. wall, all four edges beveled for welding. The repairs to the pipeline, which involved mainly welding, was the slowest operation and affected the overall progress of the program to a considerable extent. This particular phase of the work also involved the greatest safety hazard, and considerable care was exercised in welding the patches to the pipeline.

With two crews converging, it was possible to shift welders, near the end of the program, from one crew to the other as required, which resulted in increased progress of the project. The amount of the repair work performed can be visualized by the amount of materials used in this phase of the work. For example: a total of nearly 3500 lineal ft of 1/2 and 1/3 circle pipe was used, also slightly over 2½ tons of arc welding rod was used. This welding work, on a weakened pipeline under normal operating pressure, was accomplished without a lost time accident.

Pipe Wrapping

Upon completion of the repair work and priming, the pipeline was given a single wrap. This single wrap consisted of two coats of asphalt approximately 1/16-in. thick, one layer of 40-lb silica finish pipe covering and a kraft paper covering over the second coat of asphalt.

BELOW: Seal is crimped so that stretcher can be removed.

RIGHT: Box-strapping machine is removed after stopping elaks. Compression plugs at top.

The pipeline was strip wrapped using pipe covering in 18-in. widths and rolls 180 ft long. This covering was cut in lengths to go around the pipe with approximately a 6-in. overlap. The strips were cut well in advance of use and placed at intervals along the pipe to be wrapped. Two melting kettles were required to keep abreast of use, and for convenient handling, the asphalt was obtained in 100-lb cartons.

A crew of four men was used in the wrapping operation, as follows: two men wrapping, one man pouring, and one man carrying the asphalt from the melting kettles. Each strip of pipe covering was used as a granny, then pulled tightly around the pipe and overlapped, as mentioned. Each strip of pipe covering was installed as closely as possible to the preceding strips, without overlapping. Another coating of asphalt was placed over the pipe covering followed by kraft paper. The strip wrap method had to be used because the pipe was too cold to use the spiral method; the asphalt set up before the spiral could be started. It was not necessary to use bands on the wrapping to hold it in place; the cold pipe tended to draw the wrapping tightly around the pipe and inspection at various locations revealed a good bond between pipe and wrapping. The asphalt was heated to about 350°F for this application.

Asphalt saturated strip was used at field joints, bends and other locations where obstructions occurred. The use of this material saved considerable time because of ease of handling. The saturated strip was obtained in rolls approximately 4 in. in diameter which contained 36 ft of saturated strip, 6-in. wide.

The pipe wrapping moved faster than any other phase of the project and no problems were encountered.

Table 5 shows the total cost of the project and breakdown in cost per foot of pipe for each of the items.

Table 6 shows the average cost per foot of pipe for each of the items. Each item includes labor, material, equipment cost, and miscellaneous expenditures.

The pipeline from Tracy to San Pablo was installed in 1930, and except for a few short sections, was installed bare. In view of the large amount of bare pipe and the length of time in service, it was difficult to estimate the amount of material required.

Table 7 is therefore submitted for its probable value to others confronted with a similar program. The major items of material used on this project are as follows:

TABLE 5

Item	Cost — Total	Cost — Lineal Feet of pipe
1. Crop damage and survey expense	$4,784.00	$0.09
2. Recondition mains	118,057.00	2.24
3. Wrap	33,382.00	0.63
Total	$156,223.00	$2.96

TABLE 6

Item	Cost Per Lineal Foot of Pipe
Excavation	$0.60
Cleaning	0.49
Repairing	1.15
Wrapping	.63
Total	$2.87
Crop damage and survey expense	.09
Total	$2.96

TABLE 7

Reconditioning Material	Quantity Total	Per Lineal Foot of Pipe	Cost Per Lineal Foot of Pipe
Sand—Monterey #4 Lapis	420.5 tons	16 lbs	$0.002
1/2 circle pipe, 20, 22 and 26-in.	482. ft		
1/3 circle pipe, 20, 22 and 26-in.	3013 ft	20 sq in.	0.14
Welding rod, 1/8, 5/32 and 3/16 in.	5353 lbs	0.1 lb	0.01
Primer and thinner	1216 gals.	0.2 gal.	0.02
Miscellaneous material			0.02
Sub Total			0.19
Wrapping Material			
Asphalt	210.5 tons	8 lbs	$0.14
Pipe covering	1367 rolls	7 sq ft	0.13
Saturated strip	756 rolls	0.02 sq ft	0.01
Miscellaneous			0.02
Sub Total			0.30
Total material cost per foot of pipe			$0.49

Conclusions

This method of reconditioning was used due to the fact that it was not possible to take the line out of service to perform the work, as there were no other pipelines that could be used to serve the (East Bay) area. The method of installing new line and taking up the old line and performing the reconditioning work at a central location was considered; however, the difficulty of shutting down the line to tie in the new section eliminated this method.

The successful completion of this project of reconditioning in place while in service, with a safety record of only two minor injuries and at a cost of less than $3.00 per ft of completed pipe, places this method on a par with other accepted methods. The progress of the work was undoubtedly slower due to using fewer men and performing the work in shorter sections. This was considered necessary in order to provide closer supervision from the standpoint of safer working conditions.

This method of reconditioning, with the experienced company personnel forming the nucleus of the reconditioning crews, provided a more flexible unit, since they were not required to confine their activities to one phase of the work. It is recommended that consideration be given to the following items before using this method of reconditioning.

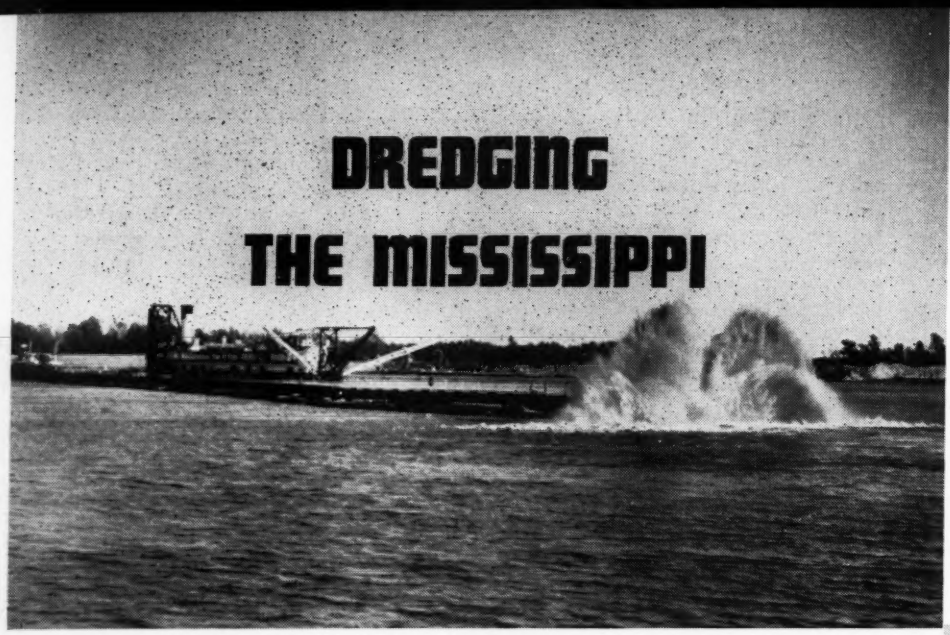
1) Determine the type of pipe and original working pressure of the pipe.

2) Conduct a pressure test to 125% of the maximum operating pressure to uncover any sections of defective pipe, prior to the excavation work.

3) Determine that adequate supervision is provided and that the supervisor remain at the job site to see that safety precautions are observed and that safety hazards are eliminated, insofar as possible.

4) Determine, prior to excavation, any underground structures to avoid probable damage claims.

DREDGING THE MISSISSIPPI



SUCTION DREDGER sprays Mississippi mud 200 ft from navigation channel shown at left.

TOP, BELOW: The "business end" of the dredger, with cutter above water. Ship is guided by anchors hanging from booms.

BOTTOM, BELOW: Close-up of massive crane block and tackle used in Mississippi crossing.

IMMENSE new equipment, especially designed for chewing up river beds, is going into action for Texas Gas Transmission Corp. of Owensboro, Ky., in its effort to cross the swift, deep Mississippi—under water.

The company wanted to lay two new, well secured 20-in. lines across the mighty river at a point near Greenville, Miss., to insure its customers against possible gas supply failure during the coming winter in case the river changes its course and disrupts any of the submarine crossings already in service.

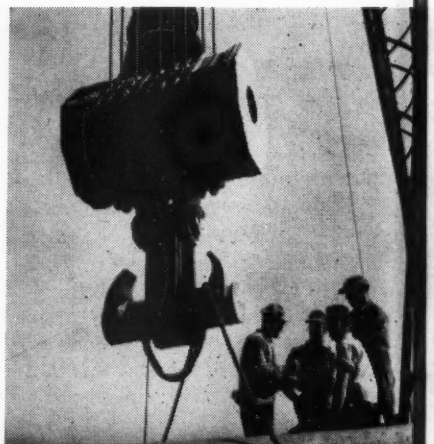
Plans called for laying two 20-in. pipes in a ditch 20 ft below the river bottom. Each line is to be 3.4 miles in length.

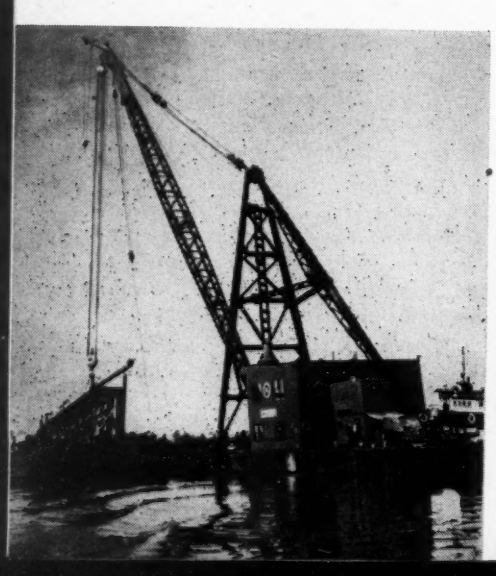
The performance of ordinary equipment falls short of the objective, so the world's largest suction dredger was called in. This mammoth masticator is capable of sucking up 50,000 cu yd of mud per day into its giant maw, and spewing it out in a heavy spray 200 yd away. Weighing 125 tons, it provides quarters aboard for a 15-man crew. Its twin booms carry anchors which, dropped to the river bottom, help to guide its maneuvers.

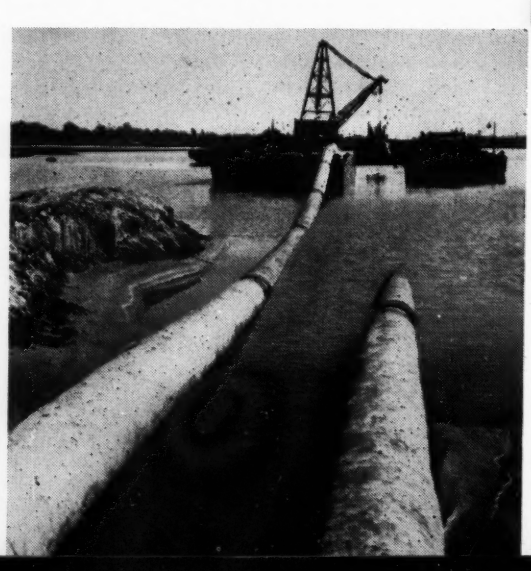
As the machine completes its portion of the job, weighted sections of pipe are floated on barges across the river, welded together, and lowered into the ditch where they'll insure uninterrupted delivery of Texas gas to customers in the Northeast.

The new lines will replace a 10-in. line installed in 1928, two 12-in., and a 16-in. no longer in service.

Schedules call for completion by Nov. 1.







PIPE IS WELDED on wooden ramp shown at far left. Waterborne crane places it there after moving it from stockpile.

AT LEFT: The pipe is laid into river channels from barges. Texas Gas Transmission is first company to lay pipe under Mississippi near Greenville, Miss., where river is swift and deep.

UNDERGROUND STORAGE...

...And Migration of Natural Gas

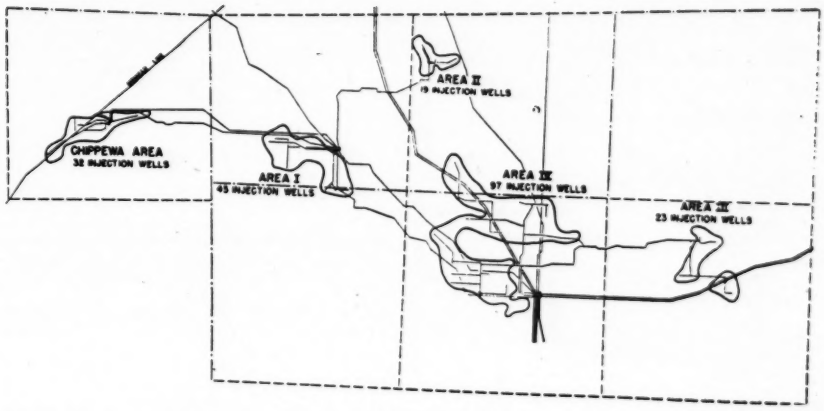


Fig. 1. Underground storage of East Ohio Gas Co. Each square is one township; total area: 10 x 24 miles.

By F. E. VANDAVEER and J. J. SCHMIDT

UNDERGROUND storage of natural gas is being widely used for a number of purposes, but its primary advantages are to meet peak loads, to prepare against pipeline failures, to permit a good transmission pipeline load factor, and to provide for the house heating load. It is of increasing importance to natural gas utilities in the northern and western sections of the United States receiving gas from the south. It will, no doubt, receive more attention by pipeline companies, and by manufactured gas companies in the East which are scheduled to obtain natural gas within the next few years. The largest gas holders of steel construction soon become too small except for short periods of peak demand.

Where local conditions are favorable to the development of underground storage so that natural gas may be used the year around many technical problems are eliminated.

(1) Interchangeability and mixing problems are avoided.

(2) Procurement of new supplies of fuel during the winter is unnecessary.

(3) Reforming processes, if used, can be stabilized.

(4) If straight natural gas is used, there is no loss of energy (no gum formation, no nitric oxide formed, and no scrubbing needed) as there is in the reforming operation.

A few historical facts will indicate that there is a wealth of exeprience on underground storage projects. Undoubtedly, a great deal more is known about this subject by operating company personnel than has been published to date. It is reported by E. G. Dahlgren[1] that the first known successful underground storage of natural gas was in Welland county, Canada, in 1915. A second storage was established in the Zoar field near Buffalo in 1916. Three years later the Menifee field[2] in Kentucky was started and is still in operation. In 1929 Cities Service established a storage project in Kansas. From that time to 1940 nineteen storage fields were started. In 1940 the Natural Gas Section of the American Gas Assn. held a symposium on underground storage at its spring meeting at which experiences[3-4-5-6-7-8] of a number of companies were related. These reports were so favorable that from 1940 to May, 1949 fifty-four additional fields[2] were established. According to Ball[2] 80 fields are now in use and fourteen more are being prepared for use. Some 615 billion cu ft of gas has been stored in them to date and 429 billion cu ft withdrawn. Eighty-five fields reported[2] have a rated capacity of 497.3 billion cu ft.

Storage of gases underground is not limited to natural gas. More than 50 MMcf of helium[1] has been stored underground by the U. S. Bureau of Mines in the Cliffside field in Texas. Millions of cubic feet of propane-air[9-10] and propane-air natural gas mixtures have been stored underground by the Michigan Gas Storage Co. in Michigan. It is reported[11] that oxygen in this mixture, about 2.3%, almost completely disappeared—only a trace remaining in the exit gas. Billions of cubic feet of coke oven gas[12] have been stored underground and recovered without any loss. It was stated that when unpurified coke oven gas containing hydrogen sulfide was stored there was a gradual decrease of this impurity in storage and a purer gas was withdrawn than was pumped into the wells—also, that there was a slight increase in heating value of gas withdrawn. Nitric oxide is being removed from the coke oven gas to prevent formation of vapor phase gum and possible plugging of the wells. Since coke oven gas contains carbon dioxide, nitrogen, hydrogen, carbon monoxide, methane, ethane, and unsaturated hydrocarbons this experience of Carnegie-Illinois Steel Corporation[12] at McKeesport, Pennsylvania means that any of those gases can be stored underground as well as other mixtures of these gases, such as in manufactured fuel gases from water gas, carburetted water gas, and oil gases.

Other papers than those already mentioned dealing with the storage of natural gas underground have been presented during the past three years. These are listed in references 13-26.

Developing Basins

There are several possibilities for developing underground basins for storage of gas. Some of these are being used, others are being studied, whereas others appear to be worthy of consideration. One or more of them could probably be used in any section of the country if the need is worth the effort. Underground storage does not have to be confined to gas or oil fields. A brief resume of six possible structures for underground storage is given below:

1. *Depleted or partially depleted dry gas fields.* Most of the underground storage pools developed to date have made use of wells in dry gas fields. This is logical as the wells are already drilled, the performance as to capacity and deliverability is known, and earth structure is known from drilling logs and other records, and the gas tightness of the field up to the original rock pressure has been demonstrated.

2. *Depleted or partially depleted oil fields.* One field (Playa Del Rey in California) still producing oil is also being used for gas storage. The reservoir space now in use for gas storage was originally wholly filled with oil. It can be expected that an underground structure which will retain oil under

Mr. Vandaveer is chief chemist, Mr. Schmidt is production superintendent, The East Ohio Gas Co., Cleveland. This paper was presented at the AGA Production and Chemical Conference May 22.

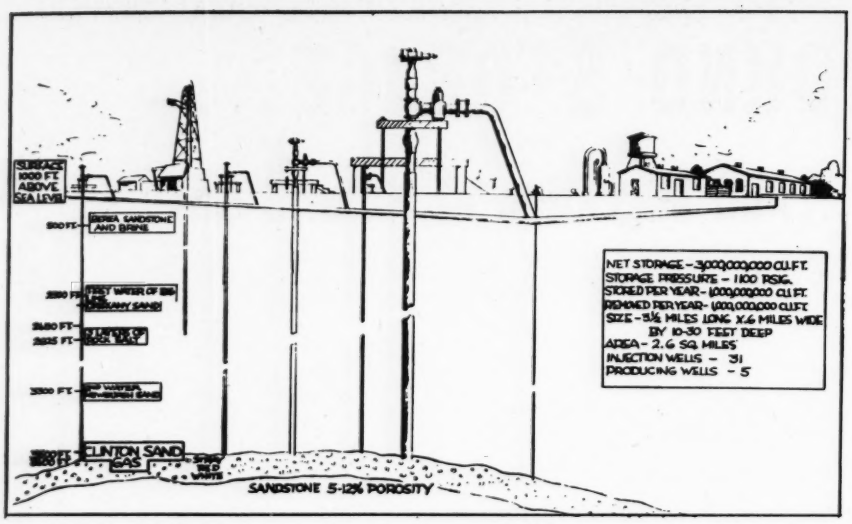

NET STORAGE - 3,000,000,000 CU.FT.
STORAGE PRESSURE - 1100 PSIG.
STORED PER YEAR - 1,000,000,000 CU.FT.
REMOVED PER YEAR - 1,000,000,000 CU.FT.
SIZE - 3½ MILES LONG X 6 MILES WIDE BY 10-30 FEET DEEP
AREA - 2.6 SQ. MILES
INJECTION WELLS - 31
PRODUCING WELLS - 5
CLINTON SAND GAS
SANDSTONE 5-12% POROSITY

Fig. 2. Chippewa underground gas storage holder.

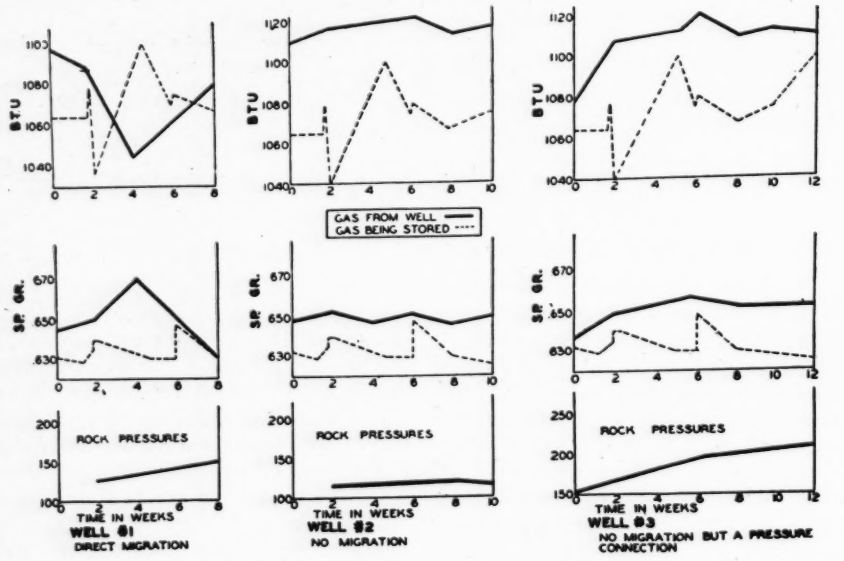


Fig. 3. Btu and sp. gr. curves of gas from test wells and of gas being stored indicates migration, no migration, and a pressure connection.

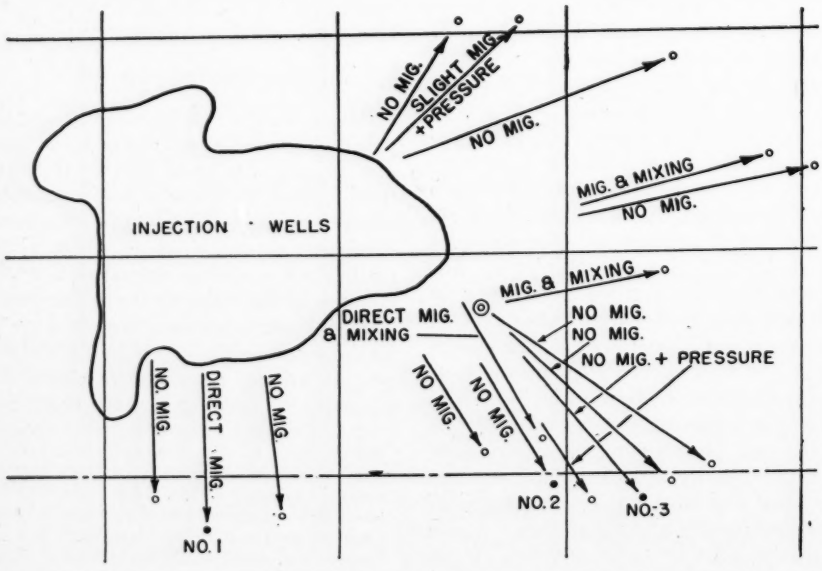


Fig. 4. Storage Area No. 1.

pressure for centuries will retain gas also. The limits of gas volume and pressure would have to be determined and controlled within reason.

3. *Excavations in sandstone, other rock layers, or coal seams.* A mining operation to create a gas tight holder in a rock layer, or the use of a natural cave, is an intriguing possibility. Sale of the stone or coal removed might be sufficient to retire the cost of the mining operation. A gas tight holder of any desired size could be created in this manner.

4. *Cavities in salt layers.* In those states where there are underlying strata of salt, cavities of known size could be made rather easily. The salt could be removed with water by methods now widely used for salt manufacture. This method of creating an underground storage would be relatively inexpensive, particularly if the salt brine were sold or converted to salt. Underlying the entire northeastern third of Ohio[27] and extending into Pennsylvania and New York State there are great layers of salt. And there are known salt deposits in 11 other states. An unknown factor in this method is whether the roof would cave in.

5. *Steel pipe or bottles buried underground.* Steel pipe[20-24-26] or bottles strong enough to hold gas under 2000 psi or more buried underground are being used for special purposes. This method is relatively expensive and is limited in capacity. Problems of corrosion of the pipe, compression of the gas to high pressure, removal of all water vapor to avoid hydrate formation and freezing are involved in this method.

Large Capacity

The primary value of underground storage is that it provides large storage capacity at a minimum cost. The smallest storage project in gas wells reported[2] to date is 700 MMcf and the largest 59 billion cu ft. To substantiate these statements a comparison of investment costs of various methods of storing Btu's is given in *Table 1*.

A brief review of *Table 1* will show how much less expensive underground storage is than any other method of storage or peak-load production.

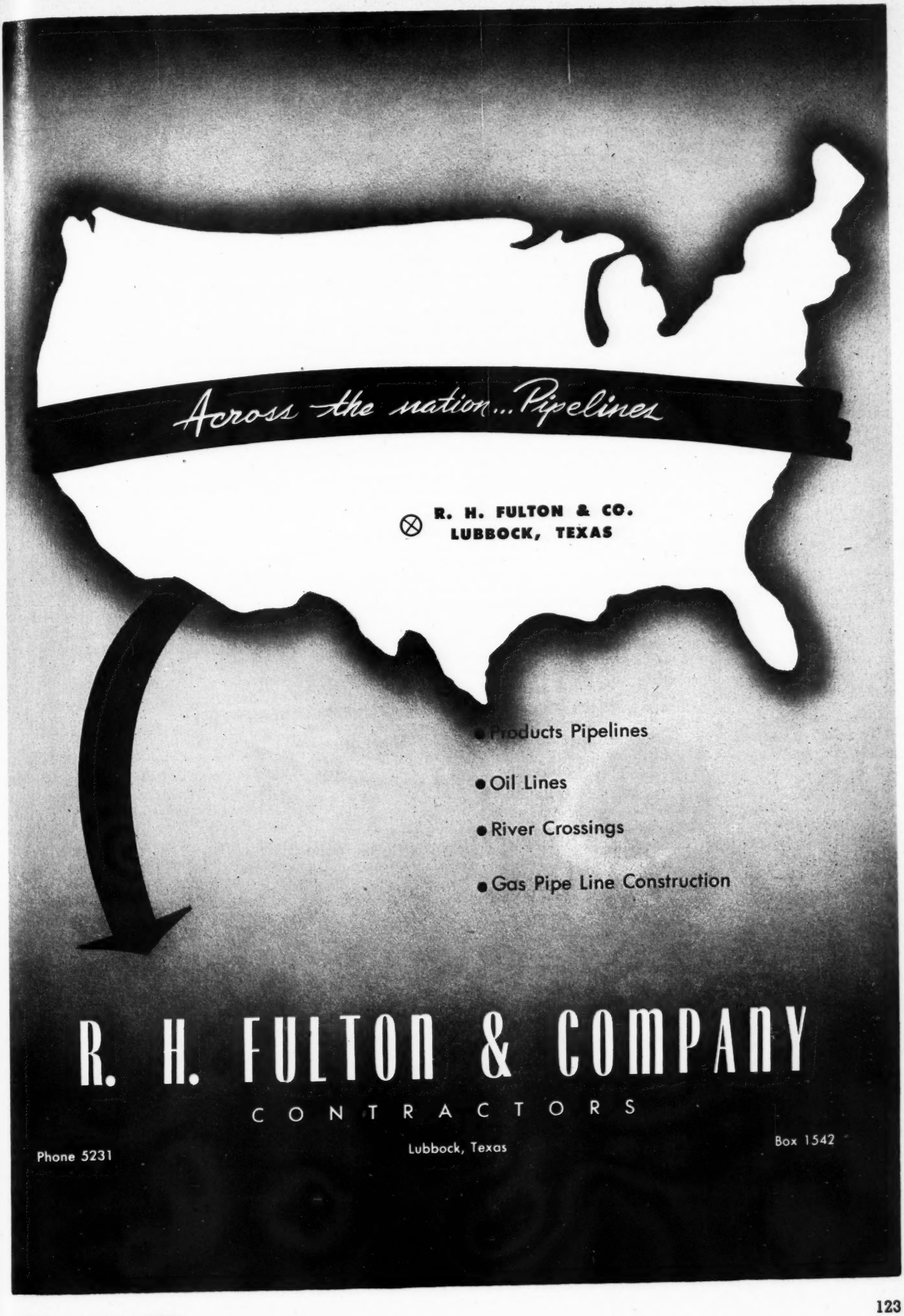
Other major economic advantages of underground storage may be enumerated as follows:

1. A larger proportion of the natural gas purchased can be sold for domestic purposes.
2. Less gas need be sold on an interruptible basis or for dump sale purposes.
3. Peak day loads from 6.0 to 66.3% of the total have been taken from storage.
4. Pipeline load factors can be maintained closer to 100% and purchase price lowered accordingly.
5. Benefits of storage last for the life of the property with relatively low upkeep.

A few details of storage field operations as conducted by The East Ohio Gas Co. may serve to clarify some items pertaining to this important subject.

In *Fig. 1* the size and relative location of our five storage areas is shown. They are about 50 miles south of Cleveland, between the cities of Akron and Canton. The Chippewa area is to the left and the Stark-Summit area consists of the four areas to the right. These areas now have 211 injection wells with numerous other producing wells around the injection wells. Total capacity of these areas at present is about 33 billion cu ft.

In *Fig. 2* typical connections from compressor station to the gas wells and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to the storage sands as well as other pertinent data on Chippewa area are given.

A total of 11,985 hp of compressors capable of pushing 118 MMcf of gas per day into storage is available.

Sandstone in which gas is being stored appear to be solid rock, but they are slightly porous to the extent of 5 to 15% of the total volume.

Gas may be both stored and removed from storage every month of the year as illustrated in *Table 2*, which shows operations during the year 1949. On warm days in the winter gas is stored and cool days in the summer or pipeline repair may cause the opening of certain wells in the area.

Geological Data

Measuring and recording of the volume of gas stored in each area as well as periodic measurement of rock pressure on each well is routine work. Wells are cleaned by watering occasionally when it becomes evident that they are not taking the gas or delivering gas as they should. Due to compression to 1100 psi, hydrates may be formed and lines to the wells or the well tubing may become plugged if the water vapor content of the gas is not kept below the dew point. For 1100 psi and 40° F this requires less than 8.5 lbs. of water vapor per MMcf of gas. Injection of methyl alcohol will prevent hydrate formation or will assist in opening a plugged line. The usual practice to free a line of hydrate is to open it and to let it blow.

Migration of Gas Underground

In selecting an underground storage area geologists and production men rely on the geological and production data. available from several years of gas production and drilling experience in the area. They know the extent of the field by the location of dry holes, abandoned wells, and small producing wells in the area. They know the amount of gas produced by each well and the rock pressure decrease over a period of time. They know about the cleanliness of the well, water and oil infiltration from a history of the well.

When the sand porosity limit is not fully defined and open necks of unknown length in a sand lense perimeter may be suspected, flow of storage gas out of the necks can be minimized by locating injection wells a mile or so from them. If there are producing wells in the open neck itself, rock pressure of these wells can be watched and gas drained off through them, or other intermediate wells, thus stopping flow of storage gas past them.

For the past four summers tests have been made in and around our storage areas to determine whether physical flow or migration of storage gas from the injection wells to other producing wells was taking place. The objectives of these tests may be stated as follows:

1. To assist in defining the boundaries of the storage area.
2. To determine whether certain wells were connected through the gas sand structure and how much resistance there was to flow of gas between them.
3. To serve as another guide in planning additional wells for more injection capacity and greater deliverability.
4. To provide further general information on physical characteristics and gas tightness of storage field.

Previous studies of this nature by others have been based on measurement of rock pressures before and during storage and withdrawal of measured volumes of gas, or addition of helium[29] to the gas being stored and subsequent analysis of gas[30] at various wells in the area for helium content. The rock pressure method was also used in these studies and provided much useful information. The helium method should be a very satisfactory one but it involves purchase of a large supply of helium and special helium test instruments. And it would necessitate isolation of the storage area during the period.

To accomplish our objectives a new method of studying underground movement of gases using common analytical equipment and no change in normal routine of storage of gas was devised. Wells to be tested were shut in for the duration of the tests. As they were normally producing wells which were shut in during the summer months, anyway, there was no interference in gas production or storage operations. The plan was based on the difference in specific gravity, or heating value, or both of the gas being stored from the gas produced by the wells being tested. Therefore a definite change or variation in specific gravity or Btu of gas samples secured from the test wells over a period of several weeks' time was an indication of flow of gas from the injection wells.

TABLE 2—OPERATIONS OF STORAGE AND REMOVAL OF GAS DURING THE MONTHS OF 1949

Month	Input Million Cu. Ft. Approx.	Withdrawal Million Cu. Ft. Approx.
January	172	728
February	136	822
March	402	1,032
April	751	43
May	1,566	7
June	1,399	9
July	1,421	1
August	2,314	2
September	2,211	3
October	2,109	4
November	612	355
December	41	1,512

Test Procedure

The general test procedure was to shut in the wells to be tested, secure gas samples and measure rock pressure on each well at intervals of one to two weeks and take samples at the same time from the gas being stored in the area. Before taking a gas sample a pressure gauge was attached to the Christmas tree and the rock pressure recorded. A valve was then opened to purge dormant gas out of the well tubing. After that the gas sample was taken in an approved, purged steel tank.

The gas samples were brought to the laboratory in Cleveland for analyses for heating value and specific gravity. A Cutler-Hammer recording calorimeter was used for heating value determinations and an Anubis balance for determinations of specific gravity.

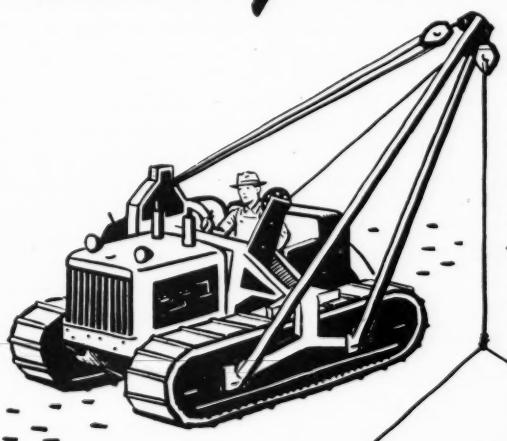
As the tests progressed the results were recorded in graph form for each well and for the gas being stored in each area. Separate graphs were kept for each well. Btu content was plotted against time in weeks and specific gravity against time in weeks on the same graph. Variation in rock pressure in psi was plotted in the same way. The graph paper used was partially transparent so that if the curves for the gas

TABLE 1—COMPARISON OF ESTIMATED CAPITAL COSTS FOR VARIOUS TYPES OF STORAGE

Type of Storage	Cost Per Mcf Dollars	Reference Number
Sphere (80 psi)	227.00	28
Steel pipe (2240 psi)	207.00	26
Gas holder (low pressure)	156.00	28
Steel pipe (1560 psi)	48.00	28
Natural gas in propane	32.00	14
Liquefaction	13.00	28
L.P.—Air (1000 Btu)	7.50	28
Catalytic reforming (1000 Btu)	3.75	28
Excavations in rock, salt, coal, etc.	—	No data
Salt cavity storage*	1.42	(Private)
Underground storage (depleted wells)	1.25	16
Underground storage (water sand)	.53	2
Underground storage (depleted wells—13 fields)	.02-.50	2

*Assuming excavation of 1 MMcf cavity and disposal of salt brine in deep brine strata. Much less if salt is recovered and sold.

Where BIG Pipelines are being Built



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being stored were held under those for each well a direct comparison of variation in Btu and specific gravity could be made. After 8-10 weeks of testing it was readily possible to determine whether well samples were being affected by migration of storage gas to them.

To illustrate how the data obtained were used to determine whether migration was taking place or not, three examples are shown in *Fig. 3*. Note in the case of Well No. 1 how the Btu varied similar to that of the gas being stored and how the specific gravity of the gas varied and finally reached .630 the same as the gas being stored—also, a gradual rise in rock pressure of some 20 lb. Direct migration was attributed to this well which was 4489 feet from the nearest injection well. An example of a well receiving no migration was Well No. 2, located 6157 feet from an injection well. The Btu and specific gravity remained practically constant and nowhere near the Btu and specific gravity of the storage gas—and rock pressure did not increase. Although Well No. 3 did not receive storage gas, as shown by the totally dissimilar Btu and specific gravity curves of the well gas as compared to the storage gas, the rock pressure increased steadily by some 85 psi. This is evidence of a pressure connection to the injection well pushing the remaining original Ohio gas in the well out and ultimately there will be direct migration.

After data on the individual wells were completed the conclusions were recorded on a map of each storage area. An example of this is shown in *Fig. 4*. The injection wells are located within area so marked at the left of the figure. Note the various conclusions of no migration, slight migration, migration and mixing, direct migration, and no migration but a pressure connection.

Four summers of testing of a total of 195 wells, taking some two thousand gas samples, and analyzing them for heating value and specific gravity have given us confidence in this method of testing for underground migration. It has accomplished the objectives set forth in this paper. Some general observations based on this work may be made which are applicable to our storage areas.

1. An appreciable increase in rock pressure may not be indicative of direct migration of storage gas at present, but it undoubtedly indicates future migration will take place when the volume of Ohio gas holding back physical flow of storage gas is decreased.

2. No increase or a very small increase in rock pressure over a period of several months cannot be regarded as absence of migration. Examples of direct migration with no pressure increase have been found.

3. In at least two instances the possibility of large pockets of Ohio gas between the injection well and the test well have been pointed out.

4. The greatest distance for gas to migrate underground observed in our tests to date is 8360 feet. Other instances of travel of more than 7000 feet have been found, but, as a general working basis, a distance of 5280 feet will stop the physical flow of gas.

To briefly summarize, this paper points out the importance and advantages of underground storage, lists some interesting historical facts about this subject including a rather complete bibliography. In addition to natural gas, other gases such as helium, coke oven gas, and propane-air have been stored underground. Five possibilities for developing underground storage in depleted dry gas fields; in oil fields; by excavations in sandstone, limestone, rock, or coal; by dissolving out cavities in salt, and in steel pipe or bottles are mentioned. The economics of underground storage are very briefly stated, and tabular data to show the extremely low capital cost involved compared to all other forms of storage or peak load gas manufacture are presented. Various phases of storage field operations are pictured and described, and data are given to show that injection and with-

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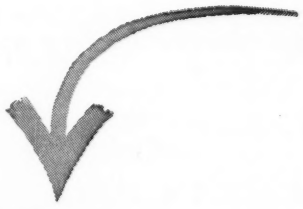

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drawal of gas from storage may occur in every month of the year. A new method of testing for underground migration of gas by comparing the Btu and specific gravity of the gas from test wells with that of the gas being stored is described and illustrated. During four years of experience with this method it has been possible to determine whether migration was occurring in 195 wells and to point out that an increase in rock pressure may not indicate migration, and that migration may occur with no increase in rock pressure. In our storage areas gas will usually not flow more than one mile underground, but a few instances of migration of 7000 ft and one of 8360 ft have been found.

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PIPELINE NEWS

MARKET DUPLICATION

Revision ordered in New England plans

WHO'S to serve Buzzards Bay Gas Co. (Hyannis, Mass.) with natural gas? Or Norwood?

Or Worcester, Spencer, Arlington, Malden & Melrose, and Suburban?

Or—in Rhode Island—Narragansett Electric Co.?

Or—in Connecticut—New Britain, Connecticut Power, New Haven, Mystic, Hartford, Greenwich, Bridgeport, Derby, Danbury & Bethel, Wallingford, and Norwich?

About these 19 companies, who all told require 30.5 billion cu ft per year, or 141.5 MMcf on a peak day, revolve the related questions of when New England will begin receiving natural gas and who will serve it. As to whether it will soon begin importation of the natural fuel there is no longer any doubt.

Such are the implications of the FPC staff counsel's brief, filed Sept. 1, recommending a reopening of the records in Docket G-1267 and G-1319 (Northeastern Gas Transmission Co. and Algonquin Gas Transmission Co.'s applications) for 45 days "to give the applicants therein, *jointly or severally*, an opportunity to propose a plan or plans to provide *one* integrated system to serve *all* of the proposed New England markets."

(The language of the brief, incidentally, was misconstrued by some news sources to infer that FPC wanted the two companies to merge, a fact which the commission strenuously denied.)

The 19 companies who stand at the vortex of the controversy are those proposed to be served by both Northeastern and Algonquin. That both transmission companies' programs include all these companies is the stumbling block preventing either company from serving any of them—at present. To award these markets to either company would automatically cancel the other company's program, because without all of them neither plan would be economically feasible.

In setting forth its arguments, the staff emphasized that should only one application be certificated as each now stands, and the other application automatically denied, "non-competitive" customers of the unsuccessful company would be left high and dry —"for some indefinite period." Since Northeastern has signed up exclusively 28 companies in Massachusetts, Rhode Island, and New Hampshire requiring 142.6 MMcf on a peak day (30.8 billion cu ft per year), and Algonquin has contracted exclusively with a dozen—including Boston Consolidated—in Massachusetts, Rhode Island, and New Jersey requiring 122 MMcf for peaks and 28 billion per year, a sizeable number of distributors would be forced to struggle along with manufactured gas only.

The answer, then, lies in the relative abilities of the two companies to serve these two "twilight zones"—thus the 45-day continuance ordered by the commission to permit

both applicants to work out plans to extend their systems accordingly.

Both, it developed, foresaw the difficulty and made a last-minute attempt to present plans for extensions. Northeastern, whose original application estimates expenditures of $26 million, thought it could do the whole job for $33.3 million, almost a million dollars less than Algonquin would require for its original program. Ultimate peak-day sendout would be 360 MMcf. Algonquin thought it could take over Northeastern's exclusive customers for a total bill of $48.2 million, with peak sendout hitting 400 MMcf—plus.

But Northeastern submitted no supporting engineering data, nor did it satisfy the commission that it had a large enough gas supply. Algonquin also indicated its willingness to take on the whole job, but it didn't make formal application for the extensions. It, too, showed a supply deficiency for the larger job.

Northeastern claims to have available 256 MMcf, Algonquin 268—both far short of the 406 MMcf needed for the peak day in the fifth year. Algonquin's ultimate capacity—400 MMcf—would be adequate, however, while Northeastern would lack some 46 MMcf of satisfying the requirements.

The commission did have a solution whereby both companies could operate in New England. Algonquin would go ahead as planned. Northeastern's proposed network would be hacked to bits, cost would be reduced to $15 million, sendout to 13 MMcf initially, 31 MMcf in the fifth year. But the only advantage of such a plan would be to make extension of Tennessee Gas Transmission's proposed line from Buffalo to the New York-Massachusetts line economically possible, thereby providing service to Albany, N. Y. and environs. TGT is principal owner and supplier of Northeastern.

But that was no good, the staff decided, because the combined costs to Algonquin and Northeastern would be $49.7 million—nearly $17 million more than Northeastern thought it would need to serve all New England.

The commission staff flatly declared itself in favor of natural gas for New England, so the toughest hurdle has been safely cleared. The area *needs* natural gas, the staff decided—but not because of any shortages or curtailments, for none exist, and not because of an urgent need for industrial gas, for none was proved. The prime need, the staff deduced, was economic.

Of the 58 companies participating in the hearings, 54 presented estimates of savings to themselves, 48 presented estimates of the percentages that could be passed along to the customers. Based on hypothetical operations for the year 1949, the 54 companies thought they could have saved themselves $15,614,000. The 48 would have passed along $8,269,000 to their customers—52.96% of the total.

The staff went a step farther and estimated savings for all 58 companies in both categories, came up with figures of $17 million and $6.9 million, the latter 56% of the former.

Concluded the staff:

"It is the opinion of the staff that there is a well-proven need for natural gas in New England and that appreciable benefits would accrue to both companies and consumers with its advent."

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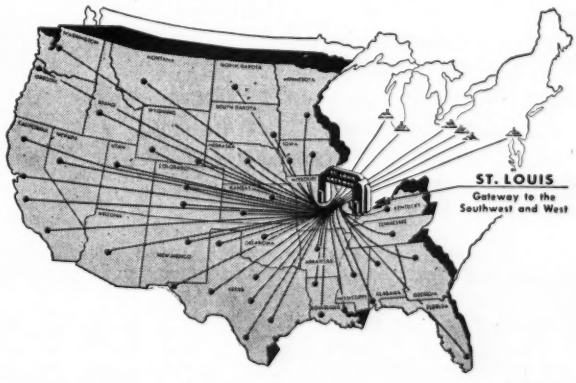

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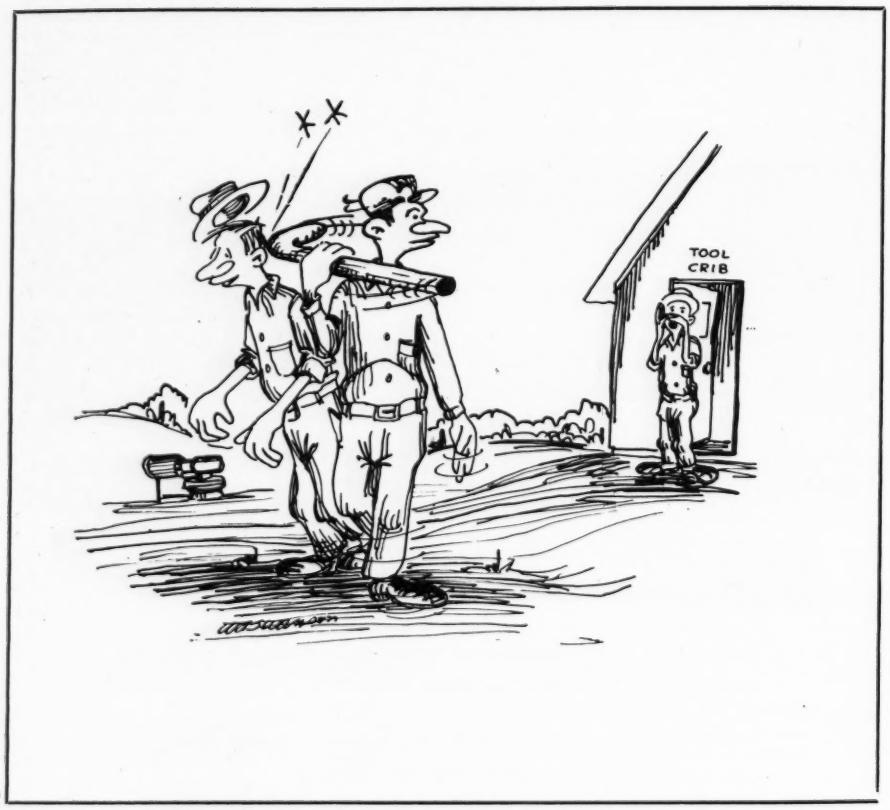

"Don't dent that pipe!"

New York-East Ohio Link To Carry 40 MMcf Winter Load

Extra volumes of gas averaging 40 MMcf per day were at least partially assured to East Ohio Gas Co. recently, when the Federal Power Commission gave temporary approval to a $3.8 million connecting link between the Cleveland utility and New York State Natural Gas Corp., New York. As high as 87 MMcf will be available for peaks.

New York State will build a 62-mile, 20-in. line in Pennsylvania—at a cost of $3,792,806—and East Ohio will build a 1-mile line in Ohio for $40,940 to make the deliveries possible.

The contract between the two Consolidated Natural Gas Co. subsidiaries specifies sales of the stated amounts during January, February, and March of the next three years. Aggregate winter sales will be about $3.6 billion.

However, a new rate schedule and service agreement must be drawn up, the commission said.

More Gas for Consumers Asked

Because everyone wants to heat with gas in the territory served by Consumers Power Co., Jackson, Mich., the company must have more gas for next winter's peaks, Michigan Gas Storage Co. told the FPC recently in applying for added compressor horsepower. Michigan Gas is a Consumers supplier.

Two 2200-hp compressors would be installed at an existing station at a cost of

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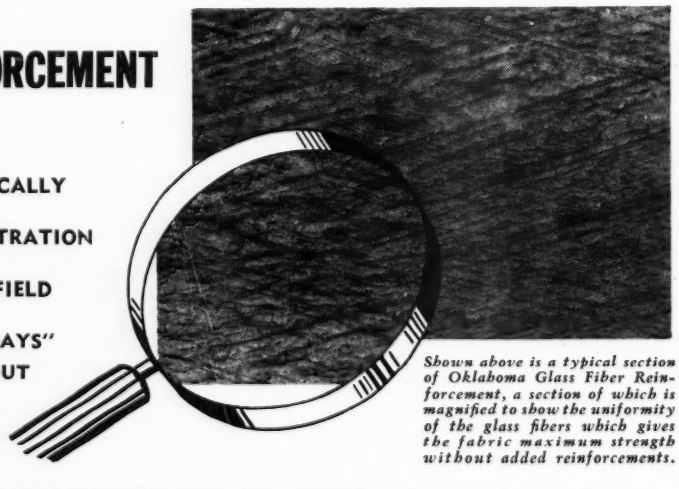

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$765,000 under terms of the application. This is presumed sufficient to enable Michigan Gas to pump up to 233 MMcf per day to Consumers, whose total needs may reach 250 MMcf.

Last winter Consumer's peak was 145 MMcf.

Pontiac, Jackson, Kalamazoo, Marshall, Flint, Hastings, Owosso, Saginaw, Alma, and Bay City would benefit.

Heating Commitments Force FPC To Okay Mississippi Program

Taking official cognizance of the possible suffering of domestic heating customers in the St. Louis area, the FPC has relented following its July 28 order rejecting Mississippi River Fuel Corp.'s (St. Louis) plan for the addition of seven new compressor stations along its system *(GAS,* September).

The company may now build four new stations and operate three others already built, and will thus meet commitments which exceeded formerly approved deliveries.

In the earlier proceeding, FPC had authorized a portion of Mississippi's proposed expansion program to permit sendout increase from 266 MMcf per day to 300, but had denied that part of the program calling for a leasing of the seven stations from Stupp Brothers Bridge & Iron Co. Then Mississippi filed an amendment seeking authorization to buy the three stations from Stupp Brothers and build the others itself. This is the scheme that won temporary approval, which expires Feb. 2, 1952.

FPC also ordered a reopening of hearings for Sept. 20 to delve further into the question of gas supply. So far, said the commission, the company had shown it had sufficient gas to satisfy its customers only up to the 1952 date.

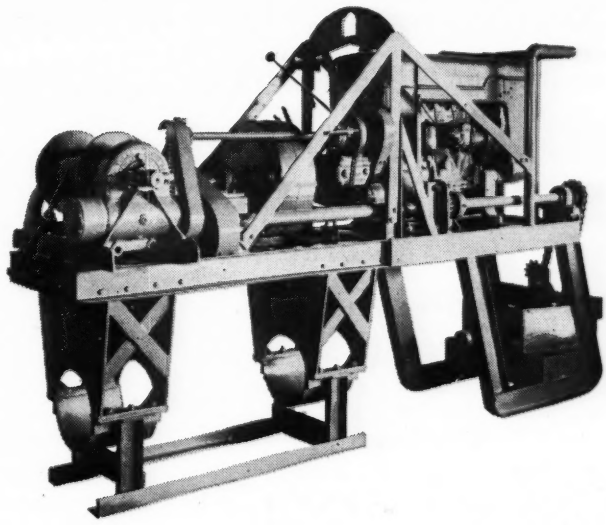
Permission was also given Mississippi to start serving Pocahantas and Corning, Ark. Pocahantas, which has been trying for 20 years to get natural gas, duly celebrated its arrival Sept. 1.

Four Columbia Subsidiaries Get Construction Certificates

Four subsidiaries of Columbia Gas System Inc. will be permitted to spend an aggregate of $1,445,000 for new gas transmission facilities under temporary blanket authorization granted recently by FPC.

Of the four companies—The Manufacturers Light & Heat Co., Cumberland & Allegheny Gas Co., Natural Gas Co. of West Virginia, and Home Gas Co., all of Pittsburgh—only Home plans to invade a new territory. A $16,000 metering and regulator station to be installed in Rockland county, N. Y., will provide Home new outlets in Ramapo, Tuxedo, Tuxedo Park, and Sloatsburg, New York, to be served through the distributor, Rockland Gas Co. Inc.

Manufacturers will lay 48 miles of new line on its existing system, build two additional 500-hp compressor units along with dehydration equipment in compressor stations, and retire 8 miles of line and 970 hp in compressor units. Natural Gas Co. will build 4.5 miles of line, and Cumberland will construct a small compressor station.



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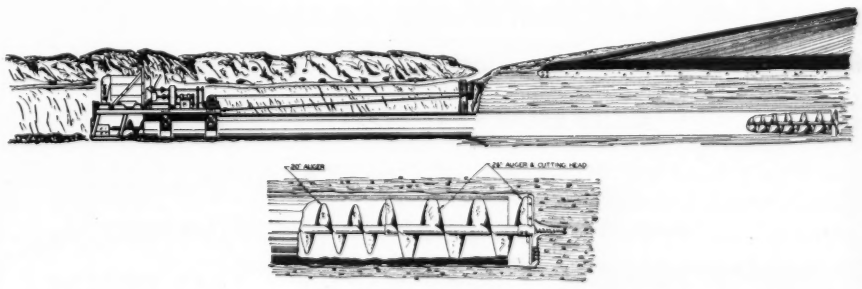

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SEC Approval Given MidSouth Purchase of Gas System

The first step toward official approval of MidSouth Gas Co.'s (Little Rock) plan to take over the job of distributing gas throughout eastern Arkansas was taken last month when the Securities & Exchange Commission authorized Arkansas Power & Light Co., also of Little Rock, to sell all its gas utility assets to the newly formed company.

MidSouth is paying Arkansas Power just under $2 million for the properties.

FPC approval is still needed on this and other features of the ambitious MidSouth program. The sale is included in one application now pending before the commission, and another plan, also pending, calls for the building of 240 miles of line from a connection with Mississippi River Fuel Corp.'s system at Helena, Ark., to serve natural gas to the 20 cities formerly served by Arkansas Power.

Conversion Planned in Indiana

Northern Indiana Fuel & Light Co., Auburn, plans to convert its system to natural gas, it told the FPC recently in filing an application seeking a connection with Panhandle Eastern Pipe Line Co.'s main line.

Northern Indiana, which serves Auburn, Garrett, Altoona, Avilla, and Kendallville with manufactured gas, and wants to add seven other Indiana cities to its list, proposes to spend $511,000 for a 31-mile line to hook in with the Panhandle system.

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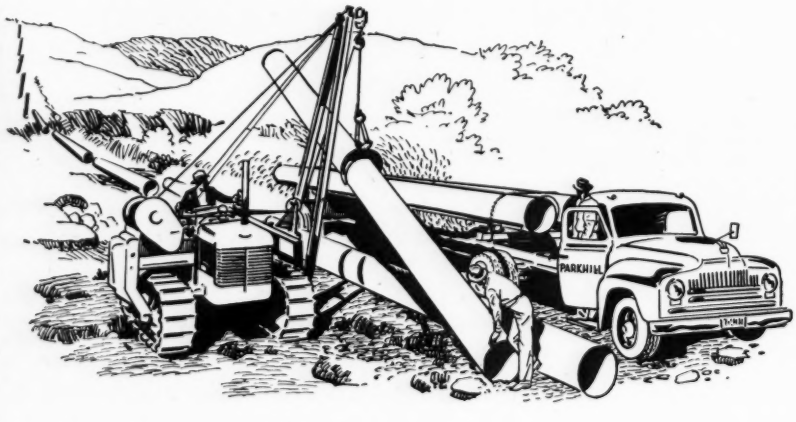

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Kansas-Nebraska Wins Okay

Kansas-Nebraska Natural Gas Co., Phillipsburg, Kan., has received an initial okay from FPC to proceed with its plan to beef up its system to 146 MMcf per day.

Examiner Marvin Farrington gave the nod to the application to install $730,000 worth of facilities, including 50 miles of line as replacement for smaller diameter pipe, 6 miles of loop, and 1640 hp additions to existing compressor stations.

Existing markets as well as new (including Pleasanton, Neb.) would benefit.

Pipeline Newsnotes

The Holland Construction Co. is back in business, according to its founder, E. T. Holland. Having opened new offices at 906 First National building in Tulsa, the company is already at work on its first contract—20 miles of 22-in. for Washington (D.C.) Gas Light.

Latest company to fall in line with a program to spur soil conservation along its pipeline right-of-way is Texas-Illinois Natural Gas Pipe Line Co., whose newly certificated line recently went into construction.

S. D. Day Co., Houston, has taken over Gulf Coast distributorship for Oklahoma Glass Fiber Corp., Tulsa. Day territory embraces Texas, Louisiana, Mississippi, and Alabama.

Pipeline People

J. F. Merriam

B. R. Bay

BURT R. BAY retired Sept. 1 as president of Northern Natural Gas Co., Omaha, the position he has held since Jan. 1, 1939. He will continue as a director. JOHN F. MERRIAM, executive vice president and a director, was elected to succeed Mr. Bay. Before joining Northern Natural as executive vice president and director in 1938, Mr. Bay was vice president and general manager of Panhandle Eastern Pipe Line Co. He is a member of the executive council and past president of the Mid-West Gas Assn., has served on the managing and advisory committee and as chairman of the Natural Gas Section of the American Gas Assn., is a former director and charter member of the Independent Natural Gas Assn., and is a member of the National Petroleum Council. Mr. Merriam has been associated with Northern Natural since 1930, the first year of the company's existence.

WILLIAM H. COBB has resigned as chief engineer for the Arkansas Public Service Commission and is now head of the engineering department of the newly formed MidSouth Gas Co., Little Rock.

E. F. Hindman
... La. Natural

Armon H. Bost
... Midwestern

EWELL F. HINDMAN has been appointed general manager of Louisiana Natural Gas Corp. by the board of directors. Mr. Hindman joined the company in 1949 as pipeline superintendent. For 20 years he was associated with Arkansas - Louisiana Gas Co., Shreveport, in various capacities including operations, gas measurement, and leakage engineering.

ARMON H. (JACK) BOST, vice president and general manager of the Midwestern Engine & Equipment Co., Tulsa, suspended his duties with the company on Sept. 15 and was inducted into the Army. Col. Bost served 5½ years in World War II and has been actively engaged in reservist work since that time. One of the original organizers of Midwestern, Mr. Bost is one of three partners who now operate the firm.

JOHN A. MULHEREN has been appointed to the newly created position of advertising manager, H. K. Porter Co. Inc., Pittsburgh. Mr. Mulheren, former manager of sales promotion and market research for *Chemical Engineer* and *Food Industries* magazines, will supervise the advertising and publicity programs of Porter and its various divisions.

FRANCIS J. McELHATTON, head of Panhandle Eastern Pipe Line Co.'s (Kansas City, Mo.) communications and cathodic protection departments since 1938, is now serving as assistant superintendent of the transmission compressor department, in addition to his other duties.

Progress Reports

Planned

ALABAMA-TENNESSEE NATURAL GAS CO., Florence, Ala., 45 miles of 8¾-in. from Muscle Shoals, Ala., to Decatur. Contract to be let by Oct. 15.

ALGONQUIN GAS TRANSMISSION CO., a 276-mile line from a connection with Texas Eastern's line at Lambertville, N. J., to Boston, with 492 miles of laterals and a compressor station in Middleton, Conn., included.

AMERE GAS UTILITIES CO., Charleston, and **BLUEFIELD (W.VA.) GAS CO.,** for service to Bluefield, Va., and Bluefield, W. Va. Amere, a measuring and regulating station. Bluefield Gas, 14.3 miles of 6⅝-in. and regulating station.

ARKANSAS-LOUISIANA GAS CO., Shreveport, 30.3 miles 8⅝-in. to be built by Crossett (Ark.) Lumber Co. and operated by Ark.-La.

ARKANSAS-MISSOURI POWER CO., Blytheville, Ark. To build line from Big Inch to serve 12 towns in two states. To start within year.

ATLANTIC GULF GAS CO., 1500 miles, Alabama to Florida, Georgia, South Carolina.

CAROLINA NATURAL GAS CORP., Charlotte, N. C., 372 miles, 18 lines, from Transcontinental Gas Pipe Line Corp. main line to North and South Carolina communities.

CITIES OF BOONEVILLE, RIPLEY, BALDWYN, Miss., to connect with Tennessee main line in Benton county, 16 miles of 6-in., 23 more miles, 11-mile tap.

CONSUMERS GAS CO., Toronto, Can., 85 miles, Buffalo to Toronto.

EQUITABLE GAS CO., Pittsburgh, 17 miles of 8- to 16-in., 3520-hp booster, dehydration plant, near Waynesburg, Pa.

GEORGIA NATURAL GAS CO., Albany, Ga., Phenix City, Ala., to Tallahassee with laterals and branches. $5.1 million.

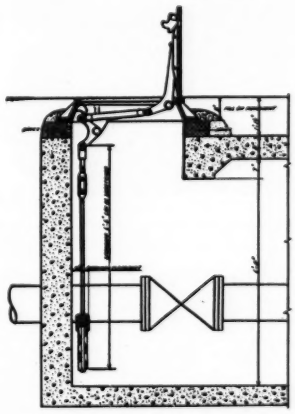
JERSEY CENTRAL POWER & LIGHT CO., Asbury Park, 7 miles.

LAKE SHORE PIPELINE CO., ERIE GAS SERVICE CO. INC., and GRAND RIVER GAS TRANSMISSION CO., pipelines from a Meadville, Pa., connection with Tennessee Gas Transmission's line westward to Ohio.

MICHIGAN GAS STORAGE CO., Jackson, Mich., to install two 2200-hp compressor units at an existing station in Michigan. Cost: $765,600.

MIDSOUTH GAS CO., Little Rock, 240 miles northerly from Helena, Ark.

NEVADA NATURAL GAS PIPE LINE CO., 122 miles of 10¾-in. line from Topock, Ariz., to Las Vegas, Nev.



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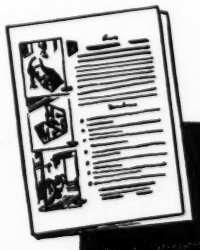

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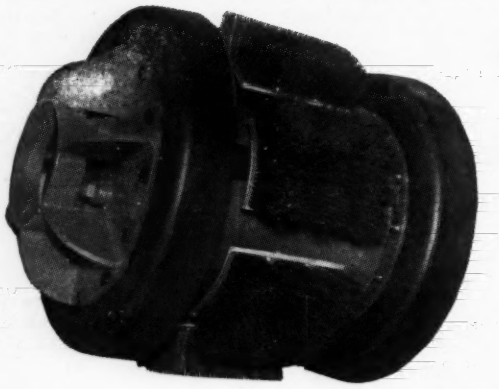

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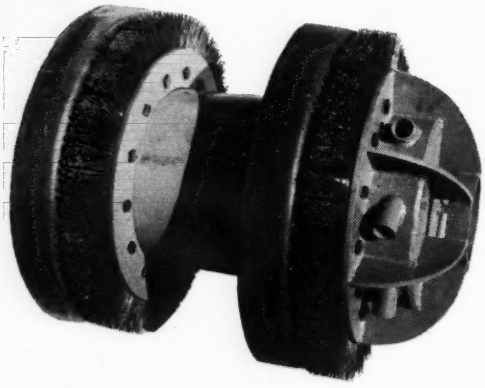

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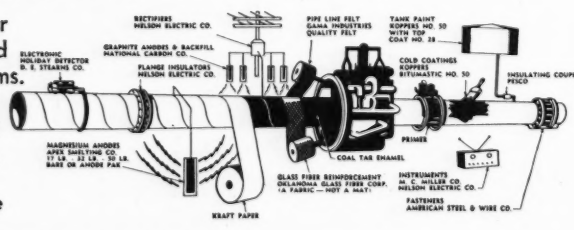
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NEW YORK STATE NATURAL GAS CO., New York, 70 miles of 20-in. from Westmoreland county, Pa., to connection with the Big Inch.

NORTHEASTERN GAS TRANSMISSION CO., pipeline to Massachusetts, Connecticut, Rhode Island, Maine, Vermont, and New Hampshire. In all, 501 miles of 3- to 20-in. line, in loops and laterals, in New England.

NORTHERN INDIANA FUEL & LIGHT CO., Auburn, Ind., 31-mile, 8⅝-in. line to carry gas to northeastern Indiana. Cost: $511,315

NORTHWEST NATURAL GAS CO., for 700 miles in Washington, Idaho, Oregon.

OHIO FUEL GAS CO., Columbus, 6 miles 18-in. sectional replacements between Sugar Grove and Mt. Sterling to be completed in Sept.; 22 miles 20-in. vicinity of Fremont and Lime City, Nov. completion expected.

PACIFIC NORTHWEST PIPELINE CORP., 2175 miles of 26-in. from southern Texas to Seattle, Wash., Vancouver, B.C., via Oklahoma, Kansas, Colorado, Wyoming, Idaho, Oregon, Washington.

PANHANDLE EASTERN PIPE LINE CO., Kansas City, Mo., for 185 miles and 16,000 hp in compressor stations. Knupp Construction Co., Great Bend, Kan., is at work on an 85-mile, 4 to 12-in. gathering system in Hugoton field.

PEOPLES NATURAL GAS CO., Pittsburgh, 16 miles of 8- and 10-in., from Tennessee Gas spur in Big Beaver to borough of Midland, Beaver county, Pa. Start July, complete August.

PIEDMONT NATURAL GAS CO. INC., Spartanburg, S. C., six laterals totaling 74 miles from Transcontinental main line to North and South Caroline cities.

PUBLIC SERVICE CO. OF COLORADO, pipeline from the Piceance Creek field in western Colorado to Grand Junction and Rifle.

PUBLIC SERVICE CO. OF NORTH CAROLINA INC., Gastonia, 365 miles connecting at 10 points with Transcontinental main line in North and South Carolina.

SHENANDOAH GAS CO., Lynchburg, Va., for 49 miles from near Cedarville, Va., to cities in Virginia and West Virginia.

SOUTH CENTRAL ALABAMA NATURAL GAS CO. INC., 150-mile pipeline from a connection with Southern Natural's line in Elmore county.

SOUTHEASTERN MICHIGAN GAS CO., Chicago, 55 miles of 12-in. from connection with Panhandle Eastern main line in Oakland county, Mich., to Marysville, Mich.

SOUTH GEORGIA GAS CO., Atlanta, for 527 miles from northern Georgia into Florida to serve new markets in the two states.

SOUTH JERSEY GAS CO., Atlantic City, 77 miles, Camden to Atlantic City.

SOUTHERN UNION GAS CO., Dallas, for 15 miles of 10-in. and 12-in. from Kutz canyon to Blanco gas field, N. Mex.

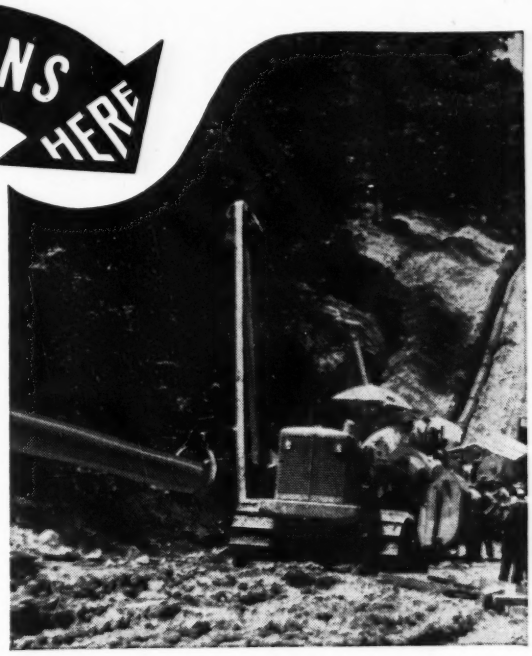
TEXAS EASTERN TRANSMISSION CORP., Shreveport, to boost capacity to 476 MMcf, 791 miles 30-in. from Kosciusko, Miss., to Connellsville, Pa.; seven compressor stations with 46,400 hp on new line, six with 52,500 hp on existing line; short lines in New York area; 35 miles of 30-in. from Fayette county, Pa., to Westmoreland county, Pa.

TRANSCONTINENTAL GAS PIPE LINE CORP., Houston, 11-mile mainline extension, 20- to 26-in. pipe, East Carteret, N. J., to Brooklyn.

UNITED FUEL GAS CO., Charleston, W. Va., 5.5 miles, 6450-hp compressor stations to deliver gas to storage pools in West Virginia.

UNITED GAS PIPE LINE CO., Shreveport, 1005 miles in Texas, Louisiana, and Mississippi. In-

PIPE LINE ECONOMY BEGINS HERE



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cludes 451 miles 30-in., 6 miles 26-in., 53 miles 24-in. from Agua Dulce field in south Texas to Monroe, La.; about 245 miles of 30, 26, 24, and 20-in. from Gulf of Mexico northeast to Jackson, Miss.; 215 miles from this line to near Kosciusko, Miss.; 24 miles 8, 12, and 16-in. in south Louisiana; 16 miles of 16-in. from Koran gasoline plant site, La., to its Carthage-Sterlington line in Louisiana; 4000-hp compressor, dehydration plant.

VALLEY GAS PIPE LINE CO. INC., Houston, $144.5 million, 1000 miles of 30-in., from Hardin county, Texas, to southern Michigan, plus 500 miles of 24-in. in Texas and Louisiana, plus laterals, two 13,500-hp compressor stations, plus others aggregating 70,000 hp. Wants to start by Dec. 31, complete April 1, 1952.

Approved

KANSAS-NEBRASKA NATURAL GAS CO., Phillipsburg, Kan., 1640-hp compressor addition, 4 miles of 2-in.; replace 16 miles of 8-in. with 12-in., 22 miles of 6-in. with 8-in., 8 miles of 4-in. with 6- and 8-in.; loop 6 miles.

MANUFACTURERS LIGHT & HEAT CO., CUMBERLAND & ALLEGHENY GAS CO., NATURAL GAS CO. OF W. VA., and HOME GAS CO. Manufacturers: 44 miles 4- and 16-in. in Ohio, Pa., and W. Va., and two 500-hp units. Cumberland: 10.3 miles 6- and 8-in. and a 65-hp station in W. Va. Natural Gas Co.: 4.5 miles of 4-, 6-, and 8-in. in Ohio. Home: meter and regulating station in Rockland county, N. Y.

MISSISSIPPI RIVER FUEL CORP., St. Louis, for compressor units totaling 28,380 hp in seven new stations.

NEW YORK STATE NATURAL GAS CORP., New York, 63 miles of 20-in., from Westmoreland county to Pennsylvania-Ohio line to connect with East Ohio Gas Co., Cleveland.

Under Way

ALABAMA-TENNESSEE NATURAL GAS CO., 70-mile line from Muscle Shoals. Ala., to Decatur and Huntsville. Also 2 miles 6¾-in. laterals to Florence and Sheffield, Ala.

ARKANSAS-LOUISIANA GAS CO., Shreveport. About 91 miles — Magnolia, Ark., to Malvern, Ark. — completed on the 163-mile, 20-in. Waskom, Texas, to Malvern line. Anderson Brothers Construction Co., Houston.

COMMONWEALTH NATURAL GAS CORP., Richmond, Va., 104 miles of 18-in., expected to be finished this month. Ray L. Smith & Son Inc., El Dorado, Kan.

CONSOLIDATED EDISON OF NEW YORK INC., BROOKLYN UNION GAS CO., KINGS COUNTY LIGHTING CO. are building lines to receive gas from Transcontinental's Texas - New York line. ConEd will build 23 miles, Brooklyn will construct 12 miles, and Kings County will build 2.9 miles.

CONSUMERS POWER CO., Jackson, Mich., Somerville Construction Co., Ada, Mich., at work on additions to Lansing, Mich., distribution system. Started Aug. 15; 50% completed.

EAST OHIO GAS CO., Cleveland, 24 miles 20-in. in Mahoning county, Ohio. Clearing right of way. To be completed in Nov. Williams Bros. contractor.

EAST TENNESSEE NATURAL GAS CO. is building 400 miles of 16-in. and 12¾-in. line from Lobelville, Tenn. to Oak Ridge. The job, including miscellaneous laterals, will be completed Oct. 1.

EL PASO NATURAL GAS CO., line from San Juan basin, New Mexico, to Topock, Ariz. Work began last month near Farmington, N.M. on the 433-mile, 24-in. line. To be completed Jan. 1.

HOPE NATURAL GAS CO., Clarksburg, W. Va., 19.5 miles 18-in. from L. L. Tonkin station at West Union, W. Va., to Fink and Marts storage field. 4 miles right of way cleared; 50% completion expected by Oct. 15.

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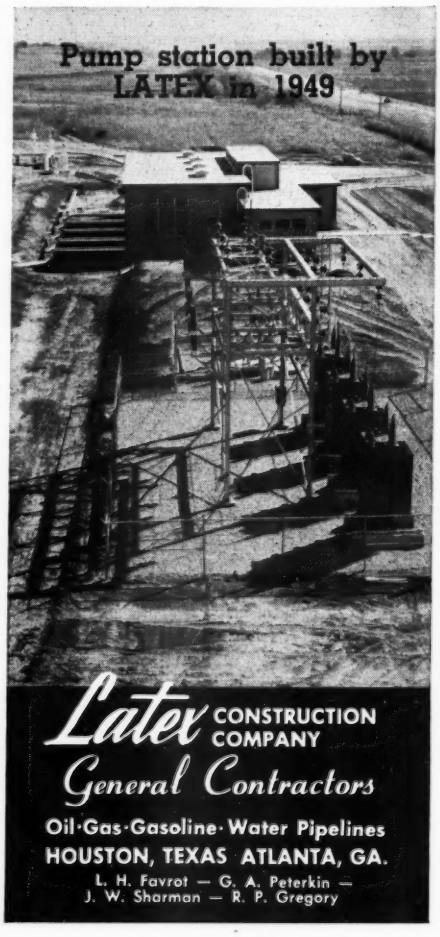

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LACLEDE GAS CO., St. Louis, started May 31, 22- to 30-in. line, in city and county. Frazier-Davis Construction Co., contractors. To complete by November.

MICHIGAN CONSOLIDATED GAS CO., Big Rapids, Mich., Somerville Construction Co., Ada, Mich., at work on distribution system at Reed City. Started Aug. 1; 80% completed.

MICHIGAN GAS & ELECTRIC CO., Ashland, Wis., Somerville Construction Co. at work on distribution system additions at Niles. Started July 1; 90% completed.

MICHIGAN GAS STORAGE CO., Detroit, 83 miles 22-in. Ovid, Mich., to Muskegon river, started Aug. 1, to be completed Nov. 15. 20 miles completed, 30 miles more by Oct. 15. Foundations poured for 7600-hp compressor station near Marion, Mich.; to be completed Dec. 1. Mahoney Contracting Co.

MONTANA-DAKOTA UTILITIES CO., a 340-mile line from Worland, Wyo. to Cabin Creek, Mont.; includes a compressor and dehydration plant at Worland. Conyes Construction Corp.

MONTANA POWER CO., Butte, 80 miles 12-in., Bozeman to Butte. Parkhill Truck Co. stringing for C. N. Deaton.

NORTHERN NATURAL GAS CO., Omaha, under way on 597 miles of mainline loops. 155 miles of 20-in. in Kansas, Fulton under way; 222 miles of 26-in. in Oklahoma and Kansas, Fulton, under way; Midwestern Constructors Inc. nearing completion on 43.4 miles of 26-in. between Palmyra, Neb., and Oakland, Iowa, 70% completed on 66 miles of 26-in. north from Oakland; Mary Construction Co. under way on 111 miles of 26-in. near Ogden and Ventura, Iowa. Parkhill Truck Co. is stringing 109 miles for Midwestern and 112 miles for Mary.

OHIO FUEL GAS CO., Columbus, R. B. Somerville, Ada, Mich., working on 12 miles 16-in., Amherst, Ohio, to Berlinville.

PACIFIC GAS & ELECTRIC CO., San Francisco. Bechtel-Price-Conyes under way on 506 miles 34-in., Topock, Ariz., to Milpitas, Calif.

PHILLIPS PETROLEUM CO., Bartlesville, Okla., 118 miles of gathering lines in Sherman and Hansford counties, Texas. Vaughn & Taylor.

PRINCE GEORGE'S GAS CORP., 18.5 miles 22-in. to Washington, D. C., metropolitan area started Aug. 15; to be completed Dec. 1. Holland Construction Co.

SOUTHERN NATURAL GAS CO., Birmingham, Ala., to start soon on 232 miles of tap lines and loops in Georgia, South Carolina, Alabama, and Mississippi; 184 miles of loops and extensions in the same states; has Sheehan Pipeline Construction Co. working on 180 miles of 18-in. from Gwinville, Miss., to Selma, Ala. Two spreads completed in Mississippi, Alabama, Georgia; Ford, Bacon & Davis to build two Mississippi taps and install 11,000 hp in existing stations.

SOUTHWEST GAS CORP., Barstow, Calif., is building a 2-mile line to Barstow from the PG&E main line; 4 miles, Barstow to U. S. Marine Corps base at Nevo; 27 miles to George air base and 5 miles from there to Victorville. All 4½-in. pipe. To be completed Jan. 1.

TENNESSEE GAS TRANSMISSION CO., Houston, has Latex Construction Co. working on 99 miles of 30-in., 68 miles from West Monroe to Natchitoches, La., completed. Remaining 32 miles from Eudora, Ark., to be finished Oct. 1; 95 miles of 20-in. from Natchitoches to Kinder, pipe laying began Aug. 20; 102 miles of 16-in. and 11 miles of 12-in. from Kinder to Bayou Sale, La., started Aug. 10. H. C. Price Co. working on remaining 153 miles of line to Buffalo through New York and Pennsylvania. Completion scheduled for Nov. Price and Morrison Construction Co. laying 158 miles of 30-in. in western Tennessee and Kentucky. 75% complete on Sept. 10. Latex working on 10 miles of 26-in. in vicinity of Greenville, Miss. river bridge, to be completed Oct. 1; two 16-in. submarine lines below Greenville bridge, started last winter, work resumed recently.

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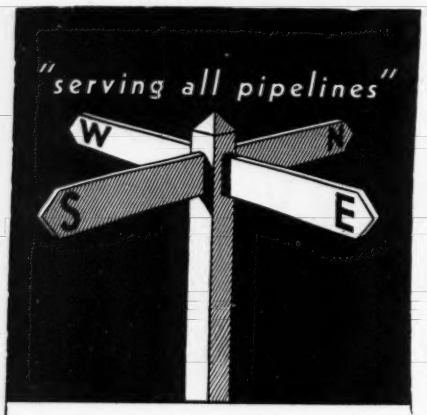

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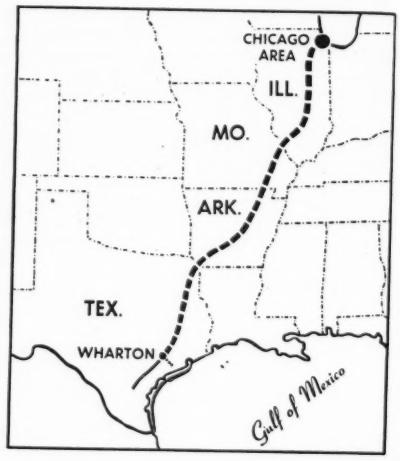
START OF A 1300-MILE TREK

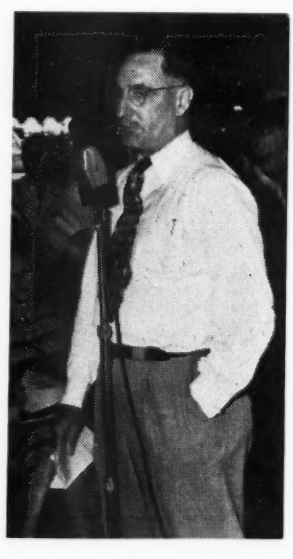
(See Pipeline Cover)

When ground was broken for the new Texas-Illinois pipeline Aug. 29, a third major carrier serving Chicago and vicinity became a reality. Two thousand men will soon be working on the trunk, which by late 1951 will carry an initial 305 MMcf (and an eventual 500 MMcf) to the Windy City. Built by Texas-Illinois Natural Gas Pipeline Co., an affiliate of Peoples Gas of Chicago, Natural Gas Pipeline Co. of America, and Chicago District Pipe Line Co., the line has its beginnings near Corpus Christi, extending through Wharton, where the groundbreaking ceremonies pictured were held, and where its size increases from 24-in. to 30-in., and terminates at Joliet and Volo, Ill. A 24-in. feeder line will join the main line at Wharton, which is 59 miles from Houston (see map).



TWO OFFICIALS AT WORK. While Oscar Hewitt, public works commissioner for the city of Chicago, strains to throw the lever on the ditch digger, E. O. Thompson of the Texas Railroad Commission gives moral support. Mr. Hewitt's efforts started the ground breaking. At right, the machine's operator stands by.

TWO TEXAS ILLINOIS officials at the microphone do their part in the celebration. At left is Mark V. Burlingame, operational vice president; at right is Joseph J. Hedrick, president. Other luminaries present included Peoples Gas Chairman James Oates, and its president, George F. Mitchell.



TENNESSEE NATURAL GAS LINES INC., Nashville, 24 miles of line and 4 meter and regulator stations, near Nashville. To be completed Dec. 1.

TEXAS GAS TRANSMISSION CO., Houston, has J. Ray McDermott & Co. Inc., Harvey, La., at work on 12-in. line from Slaughters, Ky., to Evansville, Ind.

TEXAS-ILLINOIS NATURAL GAS PIPELINE CO., Chicago, on its 1331-mile line, to Midwestern Constructors, Inc., 100 miles of 26-in. from La-Gloria, Texas, to Refugio, Texas—work to start Oct. 25; 100 miles of 30-in. from Mississippi river to Effingham, Ill., work started Sept. 25; 100 miles of 30-in. from Effingham to Sibley, Ill., and 92 miles from Sibley to Joliet, Ill.—both to start in 1951; Illinois river crossing near Morris. H. C. Price Co. is under way on 480 miles from near Refugio northeastward to Texas-Arkansas state line. Includes 38 miles, 12-in., 36 miles 24-in., 97 miles 26-in., 309 miles 30-in. Bechtel Corp. under way on 409-mile 30-in. line from Newport, Ark. Parkhill Truck Co. stringing for both jobs.

TRANSCONTINENTAL GAS PIPE LINE CORP., Houston, on its Texas-to-New York line. Victoria Oil Field Maintenance, Falfurrias, Texas, 90% complete on 61.3 miles of 6, 8 and 10-in. gathering line. Fish Constructors Inc., Houston, is building a $2 million compressor station at Dinan, Texas. Construction will take 9 to 12 months.

TRUNKLINE GAS SUPPLY CO., Houston, has Houston Contracting Co. working on 176 miles of 26-in. from Longville to Darnell, La., and 59 miles of gathering lines out of Longville, La. On Sept. 11, 30 miles were welded on first spread, Second main line spread and two spreads on gathering lines to start Nov. 1. Total completion: Dec. 20. Anderson Bros. Corp. at work on 180 miles, 26 in., Darnell to Senatobia, Miss., and 217 miles 24-in. Longville to Garwood, Texas. Parkhill Truck Co. stringing above jobs. On 740-mile, Louisiana-to-Illinois line, R. H. Fulton, Lubbock, Texas, is working on 278 miles of 12 and 20-in. and 184 miles of 26-in. Mahoney Contracting Co. under way on 186 miles of 26-in.

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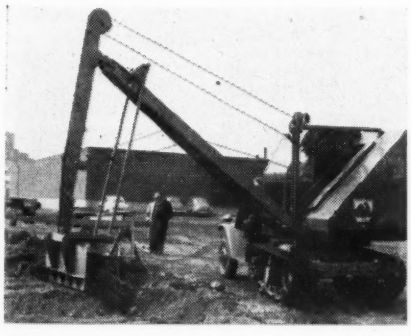
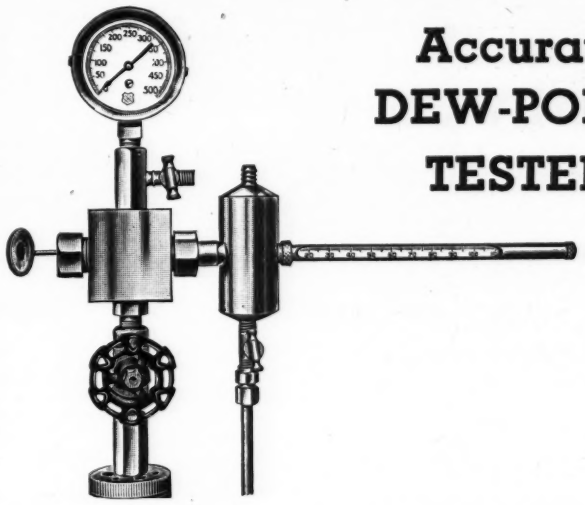


blade vertical to the ground as it is pulled toward the machine. The manufacturer claims that this "dozer" action, plus exceptionally fast mechanical controls, enables the Bantam blade to roll big loads of dirt into a trench faster and easier than scoop-type



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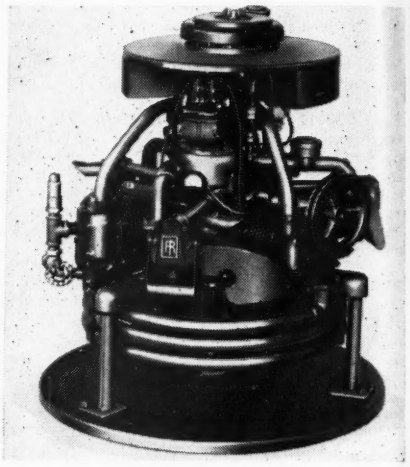
INGERSOLL-RAND CO., 11 Broadway, New York 4, N. Y.

MODEL: Spot-Air.

DESCRIPTION: This 36-cfm gasoline-driven air power unit weighs 265 lb and stands 32 in. high on a 27-in. diameter base-plate. A special wheelbarrow mounting en-



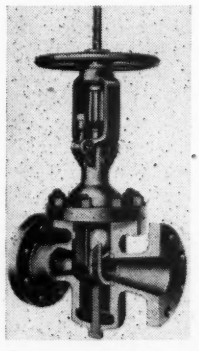
ables one man to take the compressor and air tools almost anywhere. A horizontal arrangement of three power cylinders and three air cylinders spaced alternately at 60° intervals around a vertical single-throw crankshaft gives a smooth conversion of engine power into air power without the need of a heavy flywheel. The four-cycle gasoline engine is equipped with overhead alloy steel valves with adjustable tappets. Fuel tank capacity permits from 2 to 2½ hours of continuous operation.

Ball Valve

W-K-M CO., Houston, Texas.

MODEL: W-K-M venturi ball valve.

APPLICATION: Designed for throttling in high pressure, corrosive, or erosive applications. In the throttling position, the ball presents a smooth surface, and non-turbulent flow is possible over a wide range without destructive erosion or wire drawing.



DESCRIPTION: Line contact between ball and seat assures tight, absolute shut-off. Liquids or gases going through the venturi passage suck out dirt, scale, and sediment. The ball rolls upon opening or closing, making the valve easy to operate under adverse conditions. Wear is distributed over the entire surface since the ball seats in a different position each time. There are two seats, and the valve may be reversed in the line to double its life.